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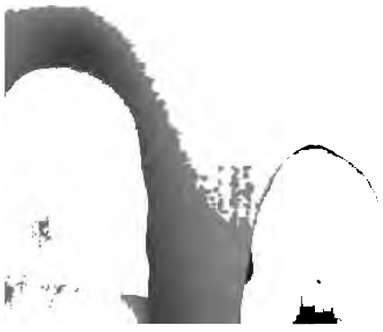

The Virginias,

A Mining, Industrial & Scientific Journal,

Devoted to

The Development of Virginia and West Virginia.

Edited and Published by

Jed. Hotchkiss,

Consulting, Mining and Civil Engineer.

Volume IV, 1883.

Staunton, Va.

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Index.

The Virginias.

No. 37. Vol. IV.—No. 1.

Staunton, Va., January, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

Index to The Virginias for 1882, Vol. III, will be sent with the Feb. No.—All subscribers desiring to have this index will please inform us, at once, by postal card.

American Institute of Mining Engineers.—The Annual Meeting of the Institute will be held in Boston, beginning Tuesday, February 20th, 1883. A subsequent notice will give the detailed programme of the meeting. Members are requested to give early information to the Secretary of their intention to read papers at this meeting.

The Iron-working Establishments of Richmond, Va., in 1882, according to the "Daily Dispatch" of Jan. 2, 1882,—including iron, nail, machine and stove works, foundries, etc.,—were 23 in number, employed 3,185 hands, had $1,830,550 capital invested, and the sales of their products amounted to $4,934,387.—The leading establishments of this character are the Tredegar Iron-works and the Old Dominion Nail-works.

Washington and Lee University, Lexington, Va., is enjoying a renewal of prosperity. At a recent meeting of its Maryland alumni in Baltimore, Prof. White stated that it has at present 130 students, a gain of 20 per cent on the previous year. The productive funds of the institution have been more than doubled in the last two years. The mineralogical and geological museums, recently added to the school's facilities for scientific instruction, and the completion of the railroads to Lexington, have contributed materially to its quickened prosperity. Colonel Allan expressed the opinion that there is no institution of learning in the South whose prospects are as bright for a healthy development in the near future.

The second term of its current session begins the 5th of next Feb., and students entering then pay but half the regular fees.

The Iron Outlook for 1883.—Rogers, Brown & Co, of Cincinnati, under date of January 1, 1883, writes us: "The new year opens with every promise of healthful activity in most branches of the iron trade Prices of pig metal, after three months' steady decline, have apparently reached bottom and are now firm and tending towards stiffness. Stocks everywhere—on furnace banks, in dealers' hands, and in yards of consumers—are exceedingly light. A heavy consumptive demand this month is inevitable The country has been using half a million tons more pig iron a year than it produces, and still the past three months' depression has driven many furnaces out of blast. Less iron probably will be made next year than this, and as much, or more, consumed. We believe purchases made now will be better than those made later."

These metal dealers now report Victoria furnace, Goshen, Va., daily capacity 200 tons, as one of their regular coke brands of pig iron.

Gem furnace, of the Shenandoah Iron, Lumber, Mining and Manufacturing Co., at Milnes, Va., is to have a "*blowing in*" on Thursday, Feb. 1, 1883, for which invitations are out. A special car will bring guests from Harrisburg, Pa., and the Shenandoah Valley RR. Co. desires the guests to visit Roanoke and the new Crozer furnace, and the machine- and car-works there after the "blowing in" has been witnessed and the mines, etc., at Milnes inspected.—We had been officially informed that this new furnace would be blown in the 20th of this month, hence the statement elsewhere.

Our Importations of Iron and Steel during the fiscal year ending June 30, 1882, as near as can be ascertained, amounted to 1,486,478 gross tons. "The Bulletin" has made a careful calculation of the quantity of raw materials and the value of labor represented in these importations, and finds them the equivalent of 1,750,000 *gross tons of pig iron*, 3,500,000 *tons of iron ore*, 3,500,000 *tons of coal, and* $56,000,000 *of wages*. The last item would pay 95,000 men for 300 working days an average of $2 a day.

Would it not have been greatly to our advantage if we had made this steel and iron ourselves rather than to have imported it, and so utilized the raw materials and labor represented by them? And yet this importation will continue and increase, to the detriment of our raw materials and labor, if these and their products are not adequately protected by a judicious tariff.

Proposals are invited:

By Baltimore & Ohio RR. for the masonry for a bridge over Brandywine creek at Wilmington, Del.

By E. H. Ruffner of U. S. Engs., Charleston, W. Va., for building Lock No. 3 of Great Kanawha River Improvement.

Virginia Iron Ores.

Analysis of Gale Iron Ores.—Under date of Dec. 22, 1882, Prof. A. S. McCreath of Harrisburg, Pa., sends the following analysis of the iron ore at the No. 1 Gale mine of the Rorer Iron Co., south of Roanoke, Va., from his own sampling:

Metallic iron	56.550
Silicious matter	5.710
Phosphorus	.178
Phosphorus in 100 parts of iron	.314

Prof. McCreath writes:—"The sample consisted of 75 pieces selected by me from ore in place to represent the *clean ore*, as development was not sufficient at the date of my visit to the property to justify the selection of a sample which might represent the *average* quality of the ore."

"You will note that the percentage of phosphorus is quite low as compared with other ores from this district. Indeed this point was so striking that I made a duplicate determination of the phosphorus with the same result."

Sale of Kennedy Iron Land.—Capt B M. Ellis has sold to Maj. J. C. Green, of the firm of McMahon, Green & Powell, railroad contractors, and John F Slaughter Esq., of Lynchburg, his undivided half of the mineral tract, known as "Kennedy," situated in the southern portion of Augusta county, near the line of the Shenandoah Valley Railroad. The entire tract contains about 4,500 acres; the other half is owned by Maj. S. M. Yost. It is the purpose of the owners of the land, as soon as the weather will permit, to place a force on it to expose the several beds of iron ore, which are known to exist there.—*Valley Virginian.*

Culpeper County Iron Ore.— 'The Exponent" states that *specular iron ore* containing 66.81 per cent metallic iron, by analysis of Maj. J. H. Morrison, analytical chemist of Va. Military Institute, has been found in a large vein on the farm of W. H. Wallis near Lignum in the lower part of Culpeper county.

Iron Pyrites, free of silica, are now in demand by the chemical works of the country. There are a good many large deposits of this ore of iron in this state and we think it would pay the owners to work and ship them, especially if near railways. They would bring about the same price as other iron ores. *Copper Pyrites* are also wanted for the same purposes; they would command a higher price. These also abound in Virginia.

Big Hill Iron Mines, Botetourt county, Va., will soon be connected with the Richmond and Alleghany RR. by a branch railway. for Masons, Hoge & Gooch, railway contractors, now have a large force at work grading the road bed, about 2½ miles long, to connect these mines with the R. & A. near its Galawater station. The owners of these very valuable iron mines, Mason, Lowry, & Hughes, have developed them so that their great beds of iron ore show up finely; while doing this they have sold a quantity of excellent ore.—It is intimated that this iron property has been priced, for a short time, to Northern capitalists who will build a large furnace there if they conclude the purchase. They could not well select a better location.

Poor Mountain Iron Ores.—The Western Blue Ridge in the southwest part of Roanoke county, Va.,—the ragged chain along the base of which runs the Norfolk & Western Railroad between Salem and Big Spring,—is locally called Poor mountain, because its soil is poor. Recent developments that have been made along its western spurs prove that in iron ores it is a very *rich* mountain. The natural outcrops of No. I, or Potsdam, ores on the "Bott," "Thomas," "Hall," and other lands, a short distance from the Owens tank of N. & W. Ry., are quite conspicuous, but a few days of labor recently expended by Messrs. Rorer & Chapman of Roanoke, the owners of the lands named, on the "Bott" farm, exposed portions of a solid stratum of ore 150 feet long, from 20 to 50 feet wide, and having a thickness that can only be ascertained by blasting. All the conditions indicate the existence there of a very large body of excellent ore above water level and within easy reach of the railway and a capital location for a furnace on Roanoke river and beside a limestone bluff.

Dr. Henry Frœhling of Richmond, Va., recently analyzed samples of these ores with the following results; the samples were dried at 212° previous to analysis.

	No. 1	No 2
Iron sesquioxide	78.770	82.100
Iron bisulphide		none
Iron protoxide		0.053
Manganese sesquioxide	2.075	1.707
Aluminum sesquioxide	1.160	1.630
Lime oxide	0.224	0 630
Magnesia oxide	0.093	0 216
Zinc oxide		trace
Phosphoric acid	0.920	1.8849
Sulphuric acid	0.0245	0.0274
Silica	8.120	6.030
Water	8.176	5.042
	99.5625	99.3208
Metallic iron	55.140	57.521
Metallic manganese	1.444	1.360
Phosphorus	0.4009	0.8215
Silica	8.120	6 030

No. 1 was from the "Bott" land, and No. 2 from the "Hall'' land.

We are greatly obliged to Dr. Frœhling for these very full analyses; they are a very important contribution to our knowledge of the constituent elements of our abundant ores.

Vesuvius Iron Mines.—We stated in our last that R. S. Merryman had leased the "Kelley" ore bank of the Vesuvius furnace tract, near Vesuvius station of Shenandoah Valley RR., and that negotiations were pending for another mining lease on same lands. We have since learned that Mr. Merryman has commenced mining operations and that Messrs. Zach. T. and Ben. C. Rawlings, well known energetic railway contractors living near Vesuvius station, have concluded the second lease before referred to, leasing for a term of 5 years, on a royalty of 25 cents a ton, the "Patterson," the "Fulton," and the "McClung" ore banks of the Vesuvius estate. Their mining operations will be in Still-house hollow, near line of S. V. RR. about a mile below Vesuvius station.

New River Coal in Louisville, Ky.—A letter to the Editor from George H. Hull & Co., metal, coal, etc. dealers, of Louisville, Ky., dated Dec. 30, 1882, contains these statements:—"We take pleasure in advising you that the New River, W. Va., coal is giving excellent satisfaction for blacksmith purposes in this market.—We regard it as the purest coal accessible to market in the United States."

Pocahontas, the Flat-top coal mining village in Tazewell county, Va., the present terminus of New River branch of Norfolk & Western RR., begins the new year with good prospects for a large growth. Last February its location was a tangled forest through which wound Laurel creek a mile above its mouth in Bluestone river; now it contains nearly 1000 people, has 7 mercantile establishments, a hotel, etc. The South-West Va. Improvement Co. has opened its mines so it can ship from 1000 to 1200 tons a day of the superior Flat-top New River coal found there as soon as the railway is completed, which will be about the first of March, as the track is now laid to within about 12 miles of the place. This company has built a coal tipple, about finished grading for ample sidings, nearly completed foundations and yards for 100 bank and 100 block coke ovens, and has 40 miners' houses nearly finished; it mined 40,000 tons of coal in 1882 in driving gangways, opening rooms, etc., to be ready for large mining operations.

It is a pity that some less confusing name could not be given to this place, such as Coketown, or some other name that has not been so largely appropriated in the Virginias.—Recently a Virginia daily paper wrote about its to-be famous mines as in Pocahontas county, W. Va., and a lot of immigrant miners seeking it were sent to the village of Pocahontas opposite Petersburg, Va.

Virginia Anthracite.—The purchase by Senator Hurt, of Pittsylvania county, from Maj. John Howe, of the valuable coal lands in the northern part of Pulaski county, and his lease from Ro. S. Hoge for a period of forty years, of the coal banks now being worked by Mr. Hoge, mean a big thing for that portion of the county. These coal beds adjoin those of Maj. J. Hoge Tyler, and the coal mined by Mr. Tyler for a year past has gained a wonderful reputation and is sought after to such an extent that he has been unable to supply one-hundredth part of the demand, with his limited means of transportation. Mr. Hurt, in conjunction with Mr. Tyler, will immediately begin the construction of a narrow-gauge railroad from their banks to the New River railroad, a distance of four miles.—*Pulaski People.*

J. R. Miller of Snowville, Va., writes *The Virginias* that he has opened a bed of coal 6½ ft. thick and proved 2½ miles long and ½ mile wide, on Peak creek, Pulaski county, about 2½ miles west from Martin station of Norfolk & Western RR.; this railway runs centrally through this coal deposit. Fossil iron ore is found on the same tract.

The above coals are those of the *Lowest*, Va.. *Coal Measures*, formation No. X,—the anthracites and semi-anthracites of the North or Kitatinny mountain ranges on the western side of The Valley, the coals that are known and used along the Norfolk & Western RR. as Brush Mountain coals. Mr. Miller's bed is in the Peak creek coal-field of these measures, the one in which are the Altoona mines that now supply coal to the Holston Salt-works at Saltville.

Improvement of Great Kanawha River.—Proposals will be received until noon of Jan. 31st, 1883, by Capt. E. H. Ruffner of U. S. Engs., Charleston, W. Va., for building Lock No. 2 of the Great Kanawha River Improvement, on the right bank of the river, about a half mile below Cannelton, W. Va. This lock will be like No. 3, the one at Paint creek, 300 feet long between quoins, and 50 ft. wide at level of mitre sills. The sum available for this work is $100,000; and it is to be completed by Jan. 1, 1886.—Our contractors will do well to correspond with Capt. Ruffner.

It is good news for the Kanawha coal interests that this lock is to be constructed at once, for when it is completed the mine operators at and above Cannelton can use the river as well as the railroads for the westward transportion of their excellent coals and cokes.

Fuel Consumption in the Virginias and U. S.—Forestry bulletin No. 23 is a partial estimate of the consumption of forest products as fuel in the U. S. during the Tenth census (1880) year, by C. S. Sargent, special agent. It is accompanied by a map of the U. S. showing the character of the fuel used in the different sections of the settled portions of the country.

The estimated consumption of *wood* for domestic purposes in the Virginias is:

	Cords.	Value.
Virginia	5,416,112	$10,404,134
West Virginia	2,241,069	3,374,701

The following estimates of consumption of wood in the United States for various purposes are interesting and suggestive.

Use.	Cords.	Value.
Domestic purposes	140,537,439	$306,950,040
Railways	1,971,813	5,126,714
Steamboats	787,862	1,812,083
Mining and amalgamating precious metals	358,074	2,874,593
Other mining operations	266,771	673,692
Manufacturing brick and tile	1,157,522	3,978,331
Manufacturing salt	540,448	121,681
Manufacturing wool	158,208	425,239
Total	145,778,137	$321,962,373

Number of persons using wood for domestic fuel 32,375,074

The consumption of *charcoal* in U. S. is estimated as follows:

Use.	Bushels.	Value.
In the 20 largest cities	4,319,194	$521,316
In manufacturing iron	69,592,091	4,726,114
In producing precious metals	97,687	29,306
Total	74,008,972	$5,276,736

The map accompanying this bulletin indicates that coal is the exclusive fuel in comparatively small areas of the United States outside of the coal-producing regions, and that even in large portions of those regions wood is still the predominant fuel;—we are still a nation of wood-burners for our home fires.

Great Kanawha vs. Pittsburg Coals.

"The remarkably low prices that have so long prevailed at Cincinnati and Louisville, have existed at St. Louis, Memphis, and all the lower markets, and are held down, in a great degree, by the West Virginia and Hocking Valley coals. *Especially the former competes, assisted by natural advantages, which seem likely ere long, to possess and control all the lower markets.*

Throughout that large and abounding district, these advantages are immovable—they consist in cheaper coal-lands, cheaper mining, cheaper transportation, in being 150 miles nearer the markets, and in the more frequent rises of the Kanawha presenting more frequent shipping opportunities. This being the situation, nothing can prevent the Kanawha region from controlling this trade, but the reality of the assumed superiority of the Pittsburg coal; and, as this is disputed by the Kanawha operators, who claim that their product is unsurpassed in the world, experience of its general use can alone determine their relative excellence."—*American Manufacturer*, Pittsburg, Pa., of Jan. 19, 1883.

We had prepared a few "reinforced" remarks for the benefit of our highly valued contemporary, the "American Manufacturer" of Pittsburg, by way of offset to some atrabilious comments on the slight differences between the "Keystone Courier" and ourselves concerning the comparative merits of the coals and cokes of the Great Kanawha, W. Va., and the Monongahela, Pa., coal basins, that appeared in one of its late issues,—but it would be in bad taste to publish the remarks after the above candid confession, the drift of which we have italicised to show that the Pittsburg "coal and coke" man has reached no hasty conclusions upon this important matter,—one as to whether *a few million tons* of Pittsburg or of Kanawha coal shall supply certain markets. We tender our thanks, and those of all interested in the Great Kanawha coal basin for this terse, clear, and forcible statement of the facts in the case. The whole matter is settled when the advantages are not only "*natural*" but "*immovable*," and we would commend these statements to the careful consideration of all those that would become interested in coal lands, either as investors or operators, or as carriers or consumers As the "Manufacturer" has often stated, the Pittsburg region has no coal to spare, it will all be needed for the future use of its great industries; the Kanawha region has an unlimited quantity of better coals to spare, and so, as a matter of course, it will soon "*possess and control*" not only "*all the lower markets*" but a good many of the higher ones.

West Virginia Iron Works in 1882.

Irondale Furnace, Raccoon, Preston county, W. Va., Alex. Strausz, general manager, went into blast in Sept., 1881, and continues in to this time. It made in 1882, 8,500 tons (2268 lbs) of pig iron, 463 of which were on hand at the end of year. It uses, ore, limestone and coke, mined and made at the furnace, using, per ton of iron made, 2.4 tons calcined ore, 1 ton limestone, and 1 ton (3,600 lbs) coke.

Quinnimont Furnace, at Quinnimont station, C. & O. Ry., Fayette county, W. Va., James F. Lewis, manager, made 8,106 tons of pig iron in 1882, having been in blast about 8 months; it had but 60 tons on hand Jan. 1, 1883. The ores used were: "fossil" from Clifton Forge, "red specular" from Arcadia, and brown hematite from mines on Richmond & Alleghany and Ches. & Ohio railways.

The Belmont Nail Co., of Wheeling W. Va., ran its blast furnace 8 months of 1882, and made about 12,000 tons of pig iron, about 1,000 of which was on hand Jan. 1. This furnace will continue in blast at least until April 1, consuming the stock on hand.—The nail mills of the company during the same 8 months made 196,000 kegs of nails, about 9,000 remaining on hand Jan. 1.—The materials used in the furnace are Lake Superior and imported ores, home limestone and Connellsville coke.

(See page 6 for others.)

Virginia Iron Works in 1882.

Liberty Furnace. Shenandoah county, Va., was put in blast Sept. 8, 1881, and has been running ever since, except during a few days taken to clean boilers; it made on this run, to Jan. 1, 1883, of cold blast, charcoal, car-wheel iron 2,236 net tons. It will probably continue until spring, making 20 months on one hearth.

Amherst Furnace. William H. Jordan, manager, on line of Richmond & Alleghany RR., Amherst county, Va., made 1,300 tons of charcoal iron during 1882: it is still in blast and will continue so until about February 1st.—The ore used at this furnace comes from the Buena Vista beds, in The Valley, which belong to the same estate.

Low Moor Furnace. at Low Moor station, C. & O. Ry., Alleghany county, Va., made 9,134 tons of pig iron from Sept. 17, 1882, to the close of the year,—an average of 87 tons a day. From Jan. 1, 1882, to June 14, when it went out of blast for repairs, it made 15,058 tons; so its 1882 output was 24,192 tons in the 270 days run during the year.

The Longdale Iron Co's two furnaces at Lucy Selina, Alleghany county, Va., made about 25,000 tons of pig in 1882, having been continuously in blast throughout the year; this is an average output of 70 tons for each day of the year.

Callie Furnace. near Clifton Forge, Botetourt county, Va., connected with Ches. & Ohio Ry. by branch railway, the property of Hileman, Waring & Co., was in blast in 1882, until Sept. 23d, when it blew out for repairs, having made in that year 2,220 tons of New River coke pig iron. It is reported in Swank's Iron and Steel Works of U. S., 1882, as "one stack, 43x10, built in 1873-4, for charcoal, but since enlarged and changed to coke."—The repairs that are now being made are: A new Player hot-blast, raising the stack 5', making it 48' high, and putting in another tuyere, making the number 3 instead of 2. It is hoped repairs will be completed so the furnace can go into blast again Feb. 1, 1883.

The Southwest Virginia Forges in 1882.—We learn the following facts concerning the operations of the forges of Southwest Virginia, during the year 1882, from John W. Robinson Esq., of Graham's Forge.

Forney's forge, at Allisonia, Pulaski county, Va., was operated about 8 months by Reed Island Iron Co., producing from pig, about 50 tons (2000 lbs) of bar iron.

Graham's forge, owned by Graham & Robinson at Graham's Forge, Wythe county, Va., was in operation about 6 months made some 25 tons of bar iron from pig

Eagle furnace forge of Crockett & Co., at Eagle furnace, Wythe county, Va., a new one started in July, running 2 refinery fires, and made 20 to 25 tons of bar iron from pig.

All these forges are run by the o'd process; they only make iron for use of local blacksmiths.

The Southwest Va. Blast Furnaces in 1882.

We are indebted to our well-informed friend and correspondent, John W. Robinson, Esq.,of Graham's Forge,Wythe county. Va., for the information, under date of Dec. 28, 1882, from which we have prepared the following full and accurate account of the operations, during the year 1882, of the group of 16 *charcoal iron blast furnaces*, located in The Valley, on New river and its branches, in Smyth, Wythe and Pulaski counties, Virginia,and known as the Southwest Virginia blast-furnaces.

In transmitting this data Mr. Robinson writes: "I am sorry to say that the outlook for 1883 is not very encouraging for the iron producers. The low price of iron and the high price of labor, supplies, etc , together with our remoteness from railroad,will deter the most of us from operating our furnaces until things are better. There are no new enterprises on hand and there will be none until we can get cheap fuel."

Unfortunately for these furnaces they are all on the easterly side of The Valley while the Norfolk & Western RR. is on the westerly, a detached mountain range, for most of the distance, rising between the furnaces and the railway—hence the above statements. In order that the high grade coke—equal to any made in the U. S.—that will be made in the Flat-top coal-field, may reach the abundant and superior ores that supply these furnaces, it will be necessary to construct what is known as the Cripple Creek branch of the Norfolk & Western (one on which some work has been done). We hope to see work resumed on that branch early this year so that this region, highly favored in the character of its ores and limestones, may have a fair chance in the iron-making race. Give it cheap and good coke and railway transportation to market, and it will not need to ask favors of any; it can make a high grade car-wheel pig as cheap as the cheapest.

The operations of the furnaces in 1882, in 2000 lbs tons, were as follows:

1. *Barren Springs* went into blast April 1st; stopped in May to put in a new hearth; is now running and will continue to Feb. 1, 1883. Its average daily make was from 5½ to 5¾ tons; it has on hand about 450 tons.—This furnace property was sold Nov. 1, 1882, to C. B. Squier of New York city; it will not be run in 1883.

2. *Beverly* blew in Apr. 1st; stopped 3 weeks in July to put in new hearth and then ran until Dec. 24th, working well and making an average of 6 tons a day. It has 250 tons on hand; it will probably run this year.

3. *Brown Hill* went into blast July 1 and blew out about 1st of Jan. 1883; has made an average of 6 tons a day,doing well; has from 500 to 600 tons on hand; no preparations making for this year.

4. *Cave Hill*, (*Dry Run*), owned by Col. Robt. Sayers, blew in about 20th of June and ran 3 or 4 weeks; went in again about 1st of Sept.; has been running very well, making about 5 tons a day, and will run to 1st of Feb. Will probably run this year,but no preparations have been made as yet.

5. *Cedar Run* went into blast April 20th; was stopped about 4 weeks in Aug. by falling in of in-wall which necessitated a new hearth; has been running since and will continue until Mar 1, 1883. It has averaged 5 tons a day, and has about 200 tons on hand. It will probably make a short blast this year, but that has not been decided.

6 *Eagle*, (*Grey Eagle*), went into blast Oct. 15 and will run to 1st of next March. It has been averaging 4¾ tons a day, and has about 250 tons on hand. It will run during 1883.

7. *Irondale* blew in July 25 and ran 2 months, making 400 tons, but had to blow out on account of scarcity of transportation, labor, etc. It blew in again Dec. 1, and will run until 1st of March. Furnace worked well, making an average of 6¾ to 7 tons a day; has about 300 tons of iron on hand. No preparations yet made for this year, but owners say it will be run.

8. *Ivanhoe* ran from 1st of Apr. to 1st of Nov., averaging 10 tons a day; has from 500 to 600 tons on hand. It has been put in order and some preparations are being made for this year.

9. *New River* (*Pierce*), was in blast in Jan. and Feb , was out in Mar. and Apr. to put in a new hearth; was in blast again from Apr. 15 to Dec. 25 when it blew out. It has worked remarkably well, making an average of nearly 7 tons a day; has about 1,000 tons on hand. If price of iron continues low it will not be run during 1883.

10. *Radford* blew in about 1st of Apr. and out about 15th of Oct.; made from 4½ to 5 tons a day while in blast; has about 250 tons of iron on hand; preparations are making for running this year.

11. *Raven Cliff* went into blast May 1st and ran until Dec. 20th, working finely all the time and made fully 7 tons a day on an average. It has about 600 tons of pig on hand. It has not been decided whether it will run in 1883, but it will not be unless prices for iron are better.

12. *Reed Island* went into blast March 10th; stopped 4 weeks in Oct. to put in a new hearth; is running at close of year and will continue until 15th of Feb. 1883. This furnace did well in 1882, running 11 months and making an average of 6½ tons a day during its blast. It has about 600 tons of pig on hand. It will probably run during 1883.

13. *Speedwell* went into blast April 1 and ran to Aug. 1, when it blew out on account of damage by high waters. Went into blast again Sept. 1 and will continue to Feb. 1 of this year. It worked nicely, made an average of 5 tons a day, and has 450 tons on hand. No preparations made for this year, as yet, and its running is doubtful.

14. *Walton* went into blast in Feb. and out about Nov. 15, making a good year of 9 months with a daily average of 5 tons; has from 400 to 500 tons on hand. It will probably run this year.

15. *White Rock* blew in Apr. 1st and out in Oct.; made about 7 tons a day while in blast; has small quantity of iron on hand; owners say it will run in 1883.

16. *Wythe* went into blast June 20th and ran to Nov. 20th, 5 months, making an average of 6 tons a day. It has about 800 tons on hand, and will run this year.

It appears from the above that each of these 16 furnaces was in blast more or less during the year 1882, and that they made between 19,000 and 20,000 tons of charcoal pig (probably most of it car-wheel grade), and that about 7,000 tons of this output was in hand at the close of the year.—The average daily capacity of all these furnaces was about 100 tons. It seems that about half of them will be idle this year unless the price of iron improves.

The following was the summary of *The Virginias'* report on the operations of these furnaces in 1881, when but 11 of them were in blast. (See p 52 of 1882 Vol.)

It appears then that the 11 furnaces of the 15 above named that were in blast in 1881 made 10,080 tons of charcoal car-wheel iron, an average of 916.3 tons to each furnace, The average amount of ore required for a ton of pig iron was 2.45 tons, and the average consumption of charcoal was 155 bushels per ton made. From 730 to 850 men were employed, or from 66 to 77 to each furnace, or about one to every 13 tons of pig made.—The ores from which this high-grade pig iron was made are mined from stratified deposits among the Trenton limestones of the Great Valley.

So the production of 1882 was about double that of 1881.

The Shenandoah Iron Works of the Shenandoah Iron, Lumber, Mining and Manufacturing Co., at Milnes, Page county, Va., on line of Shenandoah Valley RR., have long been known for the superior excellence of the neutral charcoal pig iron and blooms made there; now attention is directed to them by the improvements, recently made, that come into use with the new year.—The assistant secretary of the company, C. H. Price, furnishes *The Virginias* a statement of the company's operations in 1882 and intentions for 1883.

Furnace No. 2 was in blast during 1882 and made 2,400 tons of pig, of which about 300 were on hand Jan. 1st, when this furnace was still in blast, making an average of 8 tons a day. The fuel recently used was about equal proportions of charcoal and coke, a practice that will probably be continued. After the new furnace, described below, gets fully in blast, it is the intention to make such improvements in Furnace No. 2 as will amount to a rebuilding of it with increased capacity.

The "Gem," the new 70x15 modern furnace that this company has just completed near Milnes station, and that has had a drying fire in it for some time, went into blast the 20th of this month; it will use coke exclusively and is expected to make 75 tons and upwards of pig a day. The coke used will be that of the Bluestone-Flat-top field as soon as the Pocahontas ovens can supply it.

The Forge at Milnes was idle most of 1882 and made but 811 tons of blooms. It started again Jan. 2nd.

This company, of which Hon. Wm Milnes Jr. is president and general manager, has great advantages for manufacturing a high grade of iron at a low price. It has an abundance of easily mined rich ores—both No. I and No. V, railway facilities to its mines and to markets, and will soon have the best of coke, at a low price, from Flat-top. It begins the new year with bright prospects, having two furnaces and a forge in blast and several iron ore mines in operation.

Condition of Virginia and West Virginia Blast Furnaces Jan. 1, 1883.—The "Iron Age" of Jan. 18 contains a compilation of the condition of the blast furnaces of the U. S. on the 1st of this month. The following are the figures given for Virginia and West Virginia and for the whole U. S.

Charcoal:

	Va.	W. Va.	U. S.
Total number of stacks	31	6	255
Number reported in blast	10	1	123
Capacity per week, tons	435	100	13,700
Number reported out of blast	21	5	128
Capacity per week, tons	1,027	525	10,860
Coke or Bituminous:			
Total number of stacks	13	7	227
Number reported in blast	5	5	138
Capacity per week, tons	1,460	2,192	53,144
Number reported out of blast	8	2	88
Capacity per week, tons	3,420	460	31,020

Elsewhere we give the condition of the Virginia blast furnaces at same date as ascertained by our own correspondence.

Riverside Iron-Works, Wheeling, W. Va., made, in 1882, about 1,500 tons (2000 lbs) of iron nails, 3,500 of rolled iron, 215,000 kegs (100 lbs) of cut nails, and 25,500 tons of pig iron. Connellsville coke was used.

The Wheeling Iron & Nail Co., located at Wheeling, W. Va,, as Secretary C. D. Hubbard informs *The Virginias*, had its furnace in blast 27 weeks in 1882 and made 16,360 tons (2000 lbs) of pig iron, 1,930 tons of which were on hand at close of year; the furnace will run most or all of 1883. Its nail factory made 160,907 kegs of nails and cut spikes, of 100 lbs each, in 1882.

The Rorer Iron Company was recently chartered and organized at Roanoke, Va., with a capital of $300,000 in shares of $100 each. At a meeting of the stockholders the following officers were elected:—Ferdinand Rorer of Roanoke, Va., President; Samuel Coit of Hartford, Conn., Vice president; Lucian D. Cocke, of Roanoke, Secretary; J. H. Sykes, of Roanoke, Treasurer: George N. Gray, of Ironton, Ohio, General Superintendent and Sales Agent; A. B. Westcott, Mines Manager; and C. T. Conrad, Engineer.—The corporators were F. Rorer, S. Coit, J. H. Sykes and G. N. Gray, of the above named, and E. G. McClanahan of Roanoke. The principal office of the company will be at Gale, its mining village, but it will have a business office at Roanoke.

This company has not only acquired the very valuable iron ore lands south of Roanoke that were purchased not long ago by Samuel Coit, as fully mentioned in *The Virginias*, but has also secured a number of other properties lying southwestward from those and in the same range of heavily bedded ore deposits, so that it begins operations owning about 3,000 acres of iron lands containing a belt of ore outcrops between three and four miles long. It also acquires the line of railway, about 5 miles long, that Mr. Coit was constructing from the mines at Gale to Roanoke; this road is now under contract for completion by the first of next May; it will cross the Roanoke at Rorer's quarry and connect with the Norfolk & Western and the Shenandoah Valley railroads in the western part of Roanoke.

This Company has already made contracts for the delivery of 50,000 tons of its superior, neutral, brown hematite ores to furnaces on the Ohio, shipments to be made by the Shenandoah Valley and the Chesapeake & Ohio railways.—Land in the western part of Roanoke for a furnace site has been donated to this company and we have no doubt but that it will eventually engage in the manufacture of iron, as it will have every possible advantage for making it cheaply.

The "Gale" ore of this company was recently very carefully sampled—75 pieces having been taken by A. S. McCreath, Chemist of Pa. Geol. Survey, with these results:—Metallic Iron 56.550, Silica 5.710, Phosphorus 0.178,—Phosphorus in 100 parts of iron 0.314

Roanoke is to be congratulated that such a strong company, one having in itself all the elements for success, has gone to work in its vicinity.

Cheapening Salt-making.—Our friend Prof. Oswald J. Heinrich, now of Drifton, Pa., well-known for his papers on Virginia coal and other mines, writes us that he has perfected a plan for manufacturing salt by which at least half the fuel now used can be saved, especially if water-power is available near the boiling-house. This plan is now in operation on an extensive scale in Germany.—This is a matter of importance to our salt-makers at Saltville, Va., and on the Kanawha and Ohio in W. Va, and we hope they will confer with Prof. H. about it.

The Lands of the Cabin Creek Coal Company, Kanawha County, West Virginia.

The largest development that has been made, up to this time, in mining the bituminous coals of West Virginia, has been in the No. XIII, or Middle Measures, of that state in Kanawha and Fayette counties, in a belt of country about 20 miles wide, that is crossed at right angles by the Great Kanawha river and the Chesapeake & Ohio Railway. In that region there are now in operation 37 collieries having a present capacity for the production of 2,160,000 tons of coal a year;—the great variety and high character of the coals there found, the cheapness with which they can be mined, and the existing and constantly increasing facilities by rail and rivers, for sending them to both Western and Eastern markets, and the plans now perfecting for further developments, warrant the belief that the producing capacity of this remarkable coal field will soon be doubled.

Knowing of no better way to call the attention of capitalists and operators to the resources and advantages of a region than by furnishing detailed and specific information concerning a portion of it that will fairly represent the whole, we publish below and elsewhere in this issue some recent reports that have been made by experts, after personal explorations, on the large body of coal, timber, grazing, etc. lands—over 24 square miles—belonging to the Cabin Creek Coal Company, illustrating them by a map and sections.—Of the two reports here given, the first is by Prof. S. P. Sharples, of Boston, Assayer of the state of Massachusetts, and one of the special agents of the Forestry division of the last census; the other is by Capt. I. A. Welch of Virginia, a mine explorer and timber valuer of large experience and rare excellence and reliability.—*Editor.*

I. Report of Prof. Sharples.

I respectfully submit the following report, as the result of a recent visit to these lands.

As will be seen by the annexed map, these lands lay partly on the head waters of Cabin creek and partly on White Oak and Sang creeks, and Coal river. They are chiefly situated on the main divide between Coal and Kanawha rivers.

I first approached the property from the Kanawha side following the valley of Cabin creek. Cabin creek enters the Kanawha a short distance below Coalburg.

A standard gauge railway has recently been constructed up Cabin creek, to a point about three miles below the lower end of this property. The manager of this road kindly furnished me the following levels, in feet above mean tide:

Ches. & Ohio Ry. at bridge over Cabin creek .	613.5
Ten miles from mouth of creek . . .	869.5
Fifteen miles up or near upper end of lands	1,125.0

Or, in other words, a grade of 25.6 feet per mile on the first ten miles, and a grade of 51.2 feet per mile on the last five miles, will reach the upper end of this property.

The valley of Cabin creek as well as those of its branches and the valleys of Sang and White Oak creeks, are deeply eroded into broad flat bottoms and steep hill sides, giving not only an excellent opportunity for the construction of railways, but also excellent chances for locating inclines to reach the coal beds.

Coal river was formerly improved as far as Peytona, so that it was navigated by steamboats and coal barges; the dams were built of wood and have mostly decayed or have been washed out, so that at present it may be said to be without improvements, the dams now standing being rather obstructions than benefits.—The valley of Coal river is broad and offers great facilities for the construction of a railroad.

Coal river was followed from the mouth of Briar creek to the mouth of White Oak creek, and no obstructions were found, at any point, which would prevent easy access to these lands.

In riding up from Peytona a remarkable bed of sandstone was traced the entire distance along Coal river. This bed of sandstone is about 40 feet thick, and is underlaid by about the same thickness of shale at the mouth of White Oak creek. Directly over this sandstone is a bed of *cannel coal.* The shale disappears under the bed of the creek, about two miles above its mouth and about a mile below the westerly line of this property.

On the Cabin creek side a bed of sandstone overlain by a seam of *cannel coal* is also seen. This sandstone forms the bed of the creek from its mouth to a point about twelve miles from the mouth. The creek rises rather more rapidly than the strata, so by the time the upper end of the tract is reached, this sandstone is some distance under the surface. This *cannel coal* is from 24 to 40 inches thick.

Whether the two beds of sandstone above located are the same or not, I have not sufficient data to positively determine, but from a careful study of the relations of the two exposures it seems probable that they are, and that this bed underlies the entire tract.

Coals.

Three or four partial sections of the coal beds on this property have recently been made; none of these, however, are complete; they only serve to show the general character of the deposits there. The first section examined by me was the most complete. At Robert Perry's house, just below the mouth of Mud Lick hollow, there is a seam of coal, which has been worked to a slight extent for domestic use. Its altitude, by barometer, is 1,224 feet, and it is about 25 feet above the level of Cabin creek at this point. This bed of coal measures as follows:

Coal	3.5 feet.
Shale	1.0 "
Coal	1.0 "
Shale	1.5 "
Coal	1.0 "

Giving a thickness of 8 feet of which 5 are coal.—This bed probably underlies the entire tract and is only slightly cut by the creeks

The next bed was in Mud Lick hollow, at 1,460 ft. altitude; this seems to be a solid bed of six feet, without partings. The analysis of a specimen taken from its outcrop and somewhat weathered, gave the following results:

Fixed carbon	56.42
Volatile matter	38.09
Ash	4.15
Moisture	1.34
Sulphur, (mainly in pyrites)	1.68
Coke percentage	60.57
Ash in coke	6.35
Specific gravity of coal	1.2669

This coal contains:

Carbon	69.50
Hydrogen	5.40
Moisture	1.34
Sulphur	1.68
Ash	4.15
Oxygen and nitrogen	17.93

At 1,485 ft. altitude there is a bed two or more feet thick, this had not been sufficiently opened to show its true thickness. The coal has a very handsome vitreous fracture.—

The analysis of a sample gave:

Fixed carbon	57.17
Volatile matter	38.97
Ash	2.93
Moisture	.93
Sulphur	.80
Coke percentage	60.10
Ash in coke	4.98
Specific gravity	1.2219

The ultimate analysis gave:

Carbon	80.00
Hydrogen	5.61
Moisture	.93
Sulphur	.80
Ash	2.93
Oxygen and nitrogen	9.73

At 1,620 altitude was a two feet bed.

At 1,830 altitude were indications of a bed which had not been opened.

At 1,880 altitude was a bed ten feet in thickness, with six inches parting.—The proximate analysis of this gave:

Fixed carbon	51.56
Volatile matter	30.71
Ash	16.17
Moisture	1.56
Sulphur	1.87
Coke percentage	67.73
Ash in coke	23.86
Specific gravity	1.4429

The ultimate analysis gave:

Carbon	70.43
Hydrogen	4.60
Moisture	1.56
Sulphur	1.87
Ash	16.17
Oxygen and nitrogen	5.37

At 1,940 feet altitude, coal 2.0 feet.
" 2,010 " " coal 3.5 "
" 2,179 " " coal 1.0 "
" 2,185 " " coal 2.5 "

The last of the above is a coal of excellent quality, as is shown by the following proximate analysis:

Fixed carbon	58.19
Volatile matter	37.65
Ash	1.88
Moisture	2.28
Sulphur	0.70
Coke percentage	60.07
Ash in coke	3 12
Specific gravity	1.2732

Ultimate analysis gave:

Carbon	80.73
Hydrogen	5.01
Sulphur	0.70
Moisture	2.28
Ash	1.86
Oxygen and nitrogen	9.40

At 2,210 altitude was a six feet bed, the so-called "Pitch Cannel".—Proximate analysis of a sample of this gave:

Fixed carbon	55.65
Volatile matter	36 58
Ash	5.90
Moisture	1.87

The ultimate analysis gave:

Carbon	78.93
Hydrogen	4.66
Sulphur	0.82
Moisture	1.87
Ash	5.90
Oxygen and nitrogen	7.82
Coke percentage	61.55
Percentage of ash in coke	9.58
Specific gravity of coal	1.3048

There are, undoubtedly, other seams in this section which have not been opened. The decay of the coal bed and the consequent fall of the roof, frequently render it very difficult to find the location of a bed.

Crossing the dividing ridge from Cabin creek to its Raccoon fork, at William Batton's house, another section of a few of the coal beds was made, as follows:

At 1,420 feet altitude, 3 feet of coal.

At 1,430 feet altitude was a 5 feet bed, of which a proximate analysis gave:

Fixed carbon	59.96
Volatile matter	32.73
Ash	5.87
Moisture	1.44

The ultimate analysis gave:

Carbon	77.38
Hydrogen	4.90
Sulphur	0.85
Moisture	1.44
Ash	5.87
Oxygen and nitrogen	10.56
Coke percentage	65.83
Percentage of ash in coke	8.98
Specific gravity of coal	1.2885

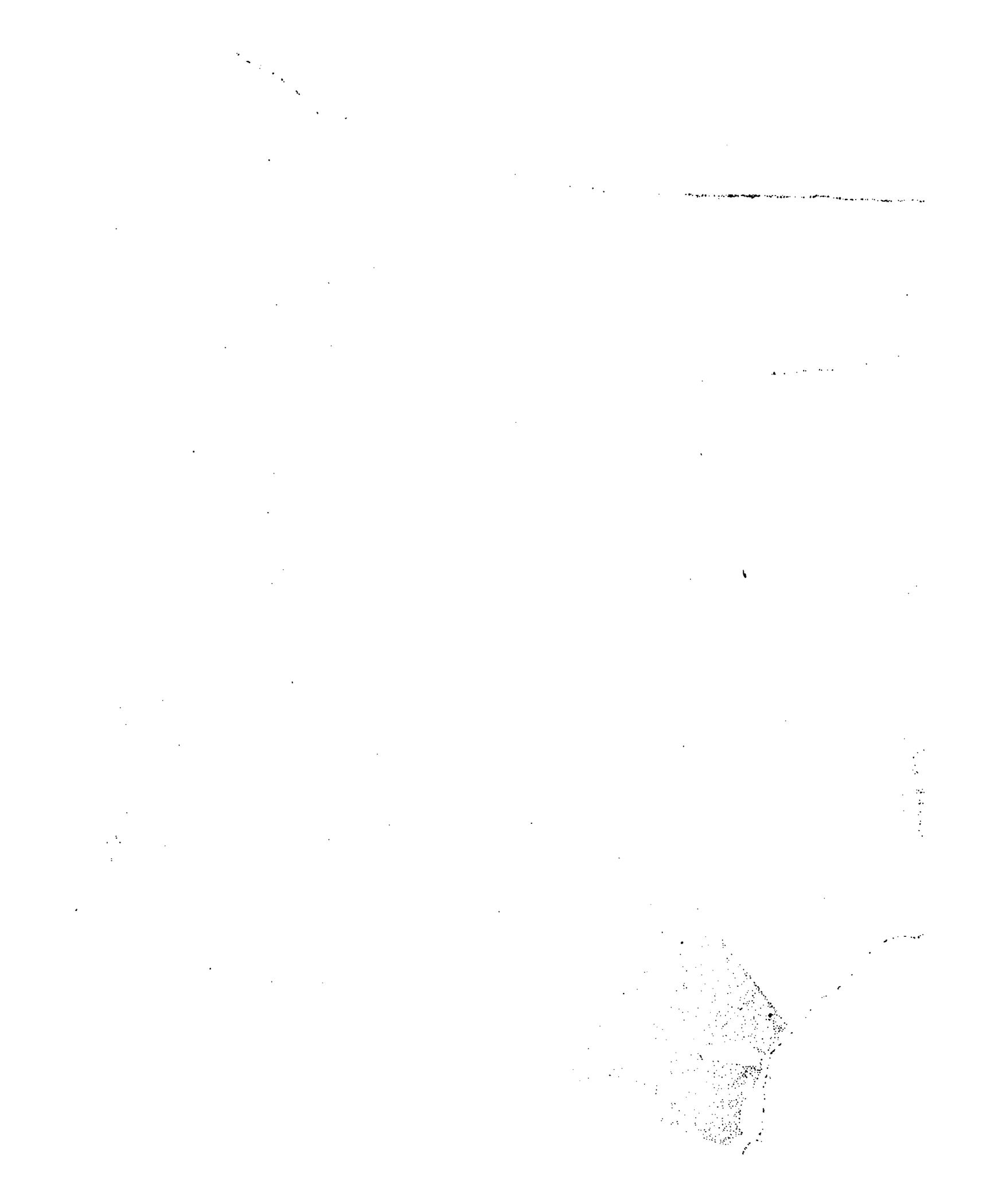
At 1,620 feet is a bed of coal 3 feet thick.

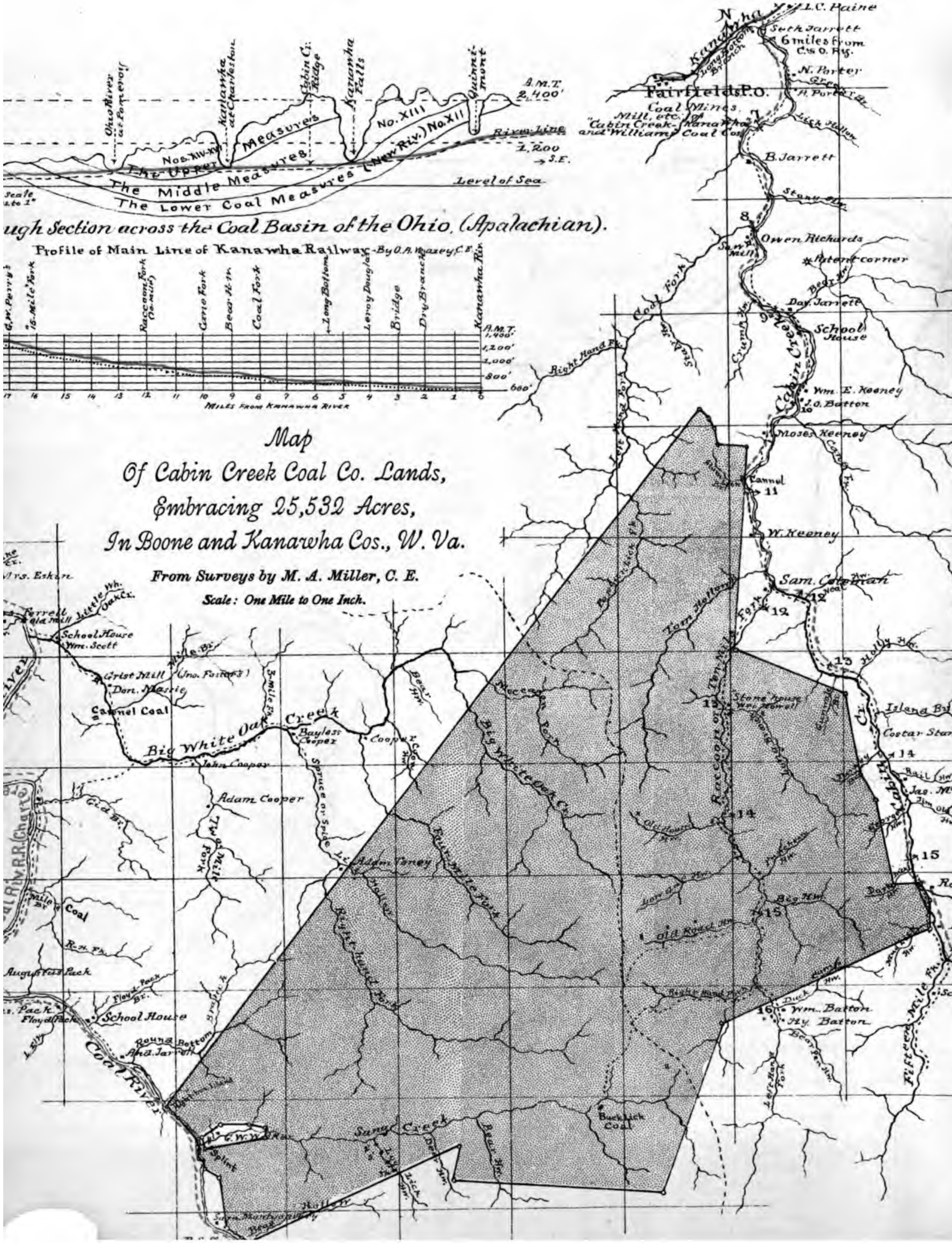
At 1,670 feet is a bed of coal 4 feet thick of which proximate analysis gave:

Fixed carbon	57.31
Volatile matter	35.97
Ash	3.47
Moisture	3.25
Carbon	73.17
Hydrogen	4.81
Sulphur	0.60
Moisture	3.25
Ash	3.47
Oxygen and nitrogen	15.70
Coke percentage	60.78
Percentage of ash in coke	5.71
Specific gravity of coal	1.3230

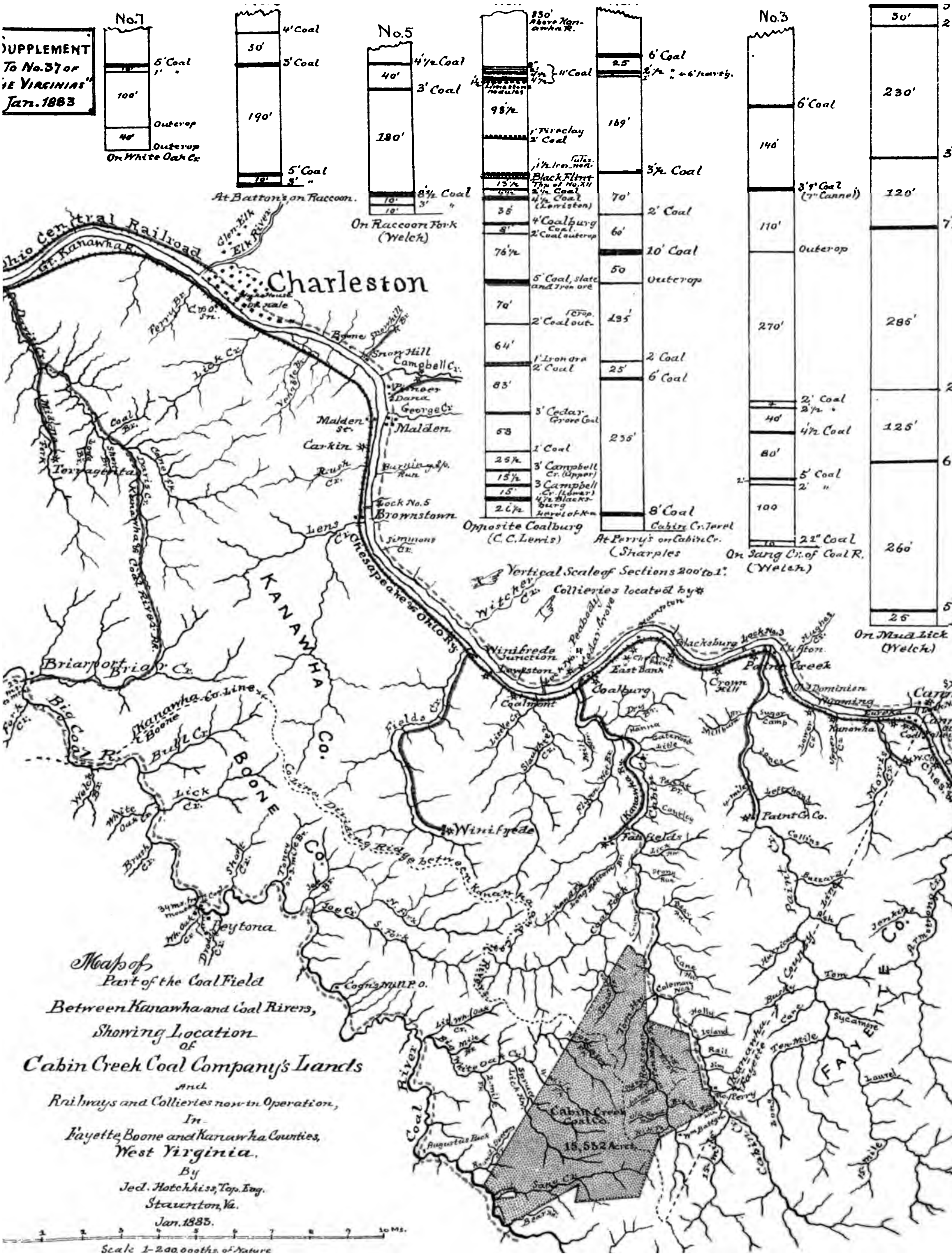
These were the only beds that have been opened at this place, and no attempt was made to find the higher beds of the section.

In Tom's hollow the following partial section was made, but the coal from it was not analyzed, the analyses of the first section having sufficiently shown the nature of the coals.

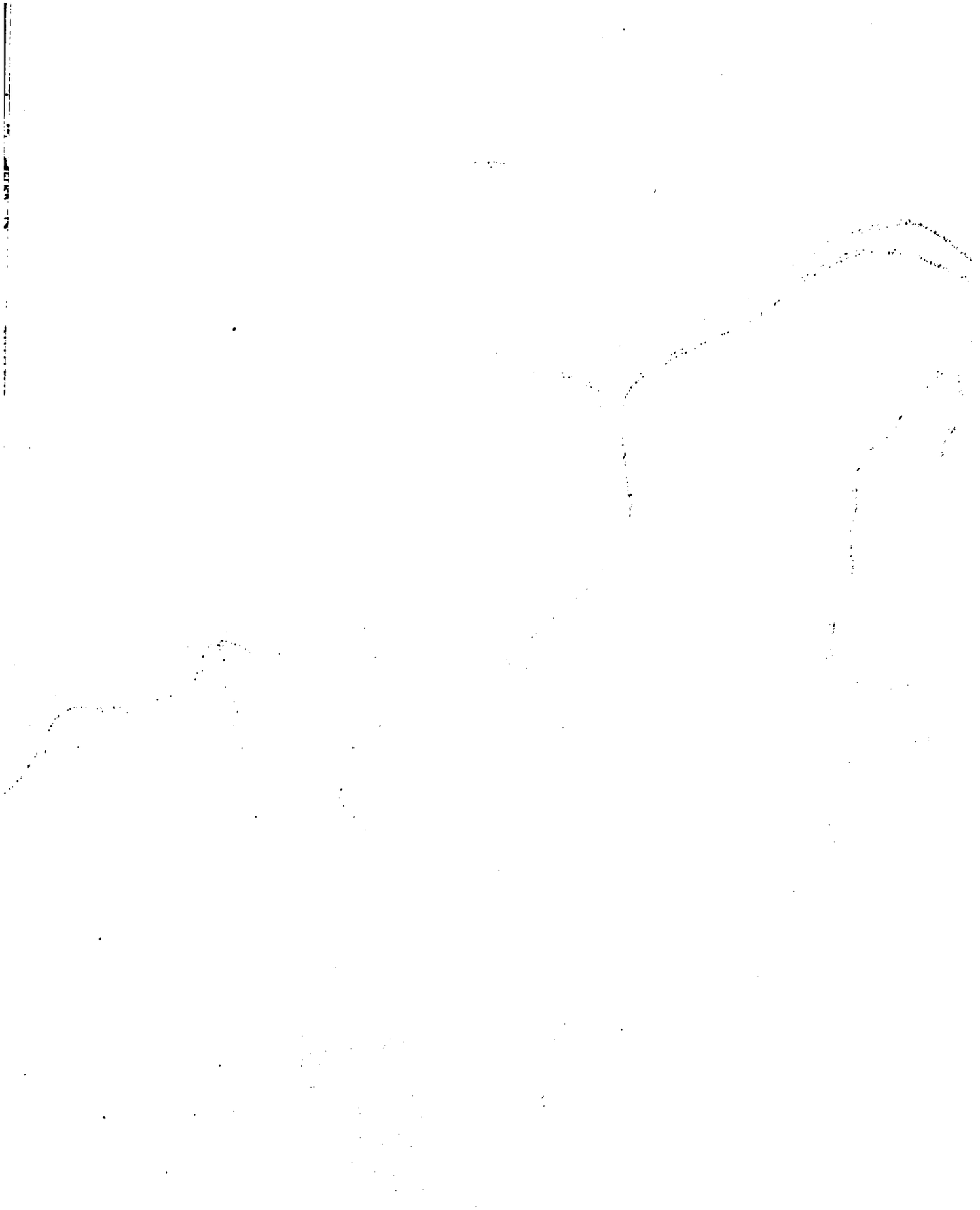




ugh Section across the Coal Basin of the Ohio. (Apalachian).
Ohio River at Pomeroy
Kanawha at Charleston
Cabin Cr. Ridge
Kanawha Falls
Quinnimont
A.M.T. 2,400'
Nos. XIV-XVI
The Upper Measures
No. XIII
No. XII
The Middle Measures
The Lower Coal Measures (New Riv.) No. XII
River Line
1,200
→ S.E.
Level of Sea
Profile of Main Line of Kanawha Railway - By O.A. Veazey C.E.
G.W. Perry's
15 Mile Fork
Raccoon Fork
Cane Fork
Bear H.
Coal Fork
Long Bottom
Leroy Douglas
Bridge
Dry Branch
Kanawha Riv.
A.M.T. 1,400'
1,200'
1,000'
800'
600'
Miles from Kanawha River
Map
Of Cabin Creek Coal Co. Lands,
Embracing 25,532 Acres,
In Boone and Kanawha Cos., W. Va.
From Surveys by M. A. Miller, C. E.
Scale: One Mile to One Inch.
L.C. Paine
Seth Jarrett
6 miles from C.&O. Ry.
N. Porter
Fairfield P.O.
Coal Mines
Mill, etc. of "Cabin Creek, Kanawha and William Coal Co."
Kanawha
B. Jarrett
Owen Richards
Patent corner
Day. Jarrett
School House
Wm. E. Keeney
J.O. Batton
Moses Keeney
Cannel
W. Keeney
Sam. Coleman
Stone House
Island Br.
Costar Stanl
Cabin Cr.
Coal Fork
Right Hand Fk.
Tom Hollow
Raccoon or Ten Mile Fork
Big White Oak Cr.
Five Mile Fork
Right Hand Fork
Big White Oak Creek
Bayless Cooper
John Cooper
Adam Cooper
Adam Toney
School House
Wm. Scott
Grist Mill
Don. Massie
Cannel Coal
School House
Round Bottom
Coal River
Sand Creek
Splint
Bucklick Coal
Wm. Batton
Hy. Batton
Fifteen Mile Fk.
Old Road Hw.
Big Hw.



Supplement To No.37 of "The Virginias" Jan. 1883
No.7
5' Coal
100'
Outcrop
40'
Outcrop
On White Oak Cr.
50'
4' Coal
3' Coal
190'
5' Coal
At Batton's, on Raccoon.
No.5
4½ Coal
40'
3' Coal
180'
8½ Coal
10'
On Raccoon Fork (Welch)
Black Flint
4' Coalburg Coal
5' Coal, slate and Iron ore
76½
70'
64'
83'
3' Cedar Grove Coal
58
1' Coal
3' Campbell Cr. (Upper)
3 Campbell Cr. (Lower)
Opposite Coalburg (C.C. Lewis)
6' Coal
169'
3½ Coal
70'
2' Coal
60'
10' Coal
50
Outcrop
135'
2 Coal
25'
6' Coal
235'
8' Coal
Cabin Cr. level
At Perry's on Cabin Cr. (Sharples)
No.3
6' Coal
140'
110'
Outcrop
270'
2' Coal
40'
4½ Coal
80'
5' Coal
100
22" Coal
On Sang Cr. of Coal R. (Welch)
30'
230'
120'
285'
125'
260'
25
On Mud Lick (Welch)
Vertical Scale of Sections 200' to 1".
Collieries located by *
Ohio Central Railroad
Gt. Kanawha R.
Elk River
Charleston
Snow Hill
Campbell Cr.
Malden
Carkin
Brownstown
Lock No.5
Lens Cr.
Chesapeake & Ohio Ry.
KANAWHA CO.
BOONE CO.
Briarport
Briar Cr.
Big Coal R.
Bull Cr.
Lick Cr.
Kanawha Co. Line
Peytona
Joe Cr.
Fields Cr.
Witcher Cr.
Winifrede Junction
Winifrede
Coalburg
Coalmont
East Bank
Blacksburg
Paint Creek
Old Dominion
Wyoming
Cannelton
Paint Cr. Co.
Coal River
Cabin Creek Coal Co.
15,532 Acres
FAYETTE CO.
Map of Part of the Coal Field Between Kanawha and Coal Rivers, Showing Location of Cabin Creek Coal Company's Lands and Railways and Collieries now in Operation, In Fayette Boone and Kanawha Counties, West Virginia.
By Jed. Hotchkiss, Top. Eng. Staunton, Va. Jan. 1883.
Scale 1-200,000ths of Nature



At 1,000 feet altitude,	Coal 4 feet.
At 1,050 feet altitude,	Coal 3.0 " Shale 0.5 " Coal 2.75 "
At 1,185 feet altitude,	Coal 10 inches. Parting 5 feet. Coal 2 "
At 1,220 " "	Coal 4.1 "
At 1,240 " "	Coal 4.2 "
At 1,300 " "	Cannel shale, Coal 2 feet.
At 1,600 " "	Coal outcrop, not opened.

Another partial section on White Oak creek gave the following on outcrops:

At 1,040 feet an outcrop.
" 1,080 " " "
" 1,180 " 1 foot of coal.
" 1,190 " 5 feet of coal.

These were all the sections personally examined by me.—In riding over the land numerous other outcrops were seen, but these, for want of time and from scarcity of labor at hand, were not opened. Those that were examined were well distributed over the land andwere sufficient to show the abundance of the coal. The coal benches or terraces which serve to show the position of the coal beds, may be traced for long distances.

In addition to the above, the following section, made on Sang creek, by Mr. Welch, may be quoted.

At 850 feet . . .	Coal river at mouth of creek.
At 860 " . . .	Coal 22 inches.
At 960 " . .	Coal 5 feet. Slate 2 " Coal 2 "
At 1,040 " . .	Coal 4.5 "
At 1,080 " . . .	Coal 2 " Slate 4 " Coal 2.6 "
At 1,350 " . .	Coal outcrop.
At 1,460 " . .	Coal 3.3 " Cannel coal 7 inches.
At 1,600 " . .	Coal 6 feet.

These very imperfect sections are distributed over the land in such a manner as to show that there is an abundance of coal above water level, and the land is so situated that the openings, if properly made, would be self-draining.

The coals examined on this tract all belong to what are known as the Middle Measures, but all the coals of the Lower Measures must also exist here, below the water level The Lower Measures beds have never been examined in this region, but they must lay within a thousand feet of the surface. These beds are fully equal in amount of thickness to those above water level.

Taking the workable coal above the water level at only twenty feet, and I am convinced that it is fully double this in amount, and allowing one half of this for erosions and waste in mining, we still have on the tract 435,600 cubic feet per acre. This at 80 pounds to the cubic foot, amounts to 34,848,000 pounds, or 17,424 tons per acre, which at a royalty of only seven cents per ton (the royalty paid in this region varies from 10 to 25 cents per ton) would amount to $1,219.68 per acre. But when we take into the account the Lower Measures, this large sum must be doubled, for there is probably more coal below the water level than there is above it.

In the various beds of coal in these lands there are found all the varieties common to this region, so that on one and the same lease all demands can be satisfied. It is an admitted fact among the operators that the coal is better in quality back from the Kanawha than just at the river; this land has all the advantages to be derived from such distance, as it lies chiefly on the main divide, between Coal and Kanawha rivers.

Timber.

Nearly all of this land is covered with timber. There have been some small clearings made in the creek bottoms, but the sides of the mountains and the heads of the streams are almost untouched. In my opinion the entire tract will yield an average of 8,000 feet, board measure, per acre, of salable timber, and still leave enough for all mining purposes. In addition to this the trimmings will yield from 40 to 50 cords per acre of wood suitable for fuel, charcoal, &c.

The chief trees are:

White or yellow poplar (Liriodendron tulipifera), very fine; some of the coves will yield as much as 20,000 feet per acre. In this region poplar is more in demand than any other timber, being extensively used for house finishing, furniture, etc. It takes the place of white pine and is always salable. There are but few tracts in this part of the state where there is as much of this timber as readily accessible as that on this land.

Cucumber (Magnolia acuminata) and Linn or Linden (Tillia Americana) are put to the same uses as poplar and are equal in value to it. Though not as abundant as the poplar, there is still a large quantity of them on this land.

There is much fine white oak there. The uses to which this is applied are too well known to need description.

Chestnut is found to a considerable amount on the ridges; some of the trees are very large. This wood is in much demand for fencing and railway ties; it is also used for furniture and house finishing, and it is almost exclusively used for telegraph poles where it can be obtained.

Sugar or curly maple (Acer saccharinum) is quite common on the land; this timber is a valuable one and is used largely for furniture and similar purposes.

Hickory and ash are about equal in quantity and well distributed over the entire tract. They are among the most valuable American woods.

White and black walnut.(Juglans cinerea and Juglans nigra,) abound in the ravines. The white walnut,though of a young growth and not very large, is abundant and of excellent quality; under the name of butternut, it is much used in house-finishing.

Along the lower water courses there is much black or cherry birch (Betula lenta). This wood is of a rich reddish brown color; it is susceptible of fine polish, and is a handsome wood for furniture or inside finishing.

Sycamore, or buttonwood, (Platanus occidentalis). There are many fine groves of tall, straight, and sound sycamores in the lower creek bottoms. This wood is in steady demand for tobacco boxes, as it is the favorite wood for this purpose; it is yearly becoming more scarce.

Beech (Fagus ferruginea), is the most abundant timber on the lower portions of the tract. This timber is steadily coming into use for various purposes connected with mining. It makes a good mine rail, and is superior to oak for coal car linings. It makes most excellent charcoal, and is much used for making pyroligneous acid.

Buckeye (Aesculus flava) is quite common in the same situations as poplar; it is now in steady demand for making paper pulp, and is used to some extent for the same purposes as poplar.

Chestnut and Spanish oaks abound on the ridges and occasionally a black oak is seen. These oaks are all valuable for their barks as well as for their timbers.

Black pine (Pinus rigida) is found in small quantities along the ridges; it is used to some extent for cross ties and for building purposes.

Dogwood (Cornus florida), which is much used for making spools, is abundant and of good quality.

There are also many fine hemlocks, (Tsuga Canadensis) in the ravines; these are valuable for their bark and also for sheathing boards, or other uses to which rough lumber can be applied.

Gum (Nyssa sylvatica) and elm, (Ulmus Americana,) are common, these are both used for making wagon hubs.

Farming Lands.

The surface of the land is generally covered with good soil, which, when cleared, furnishes excellent pasturage; much of it is too steep for cultivation, but when it can be cleared and plowed good corn is raised on it.

Conclusions.

As a whole I consider this tract as extremely valuable:

First: from its ready accessibility. The whole of the Cabin creek side is now within ten miles of a railroad, its average distance being only about five miles. Coal river side is still more convenient to the projected road up Coal river which is chartered and for which bonds have been issued.

Second: from the abundance of its coal and timber, both of which are of the best quality, and near the market, either by way of Cabin creek or Coal river.

REPORT OF CAPT. WELCH.

After as thorough an examination of the Cabin creek and Coal river tract of 15,532 acres of coal, timber, and grazing land as I could possibly make in the time given me for that purpose (about 20 days), I beg to submit the following as the result of my investigations:

Timber.

A very close timber count was taken on Sang creek at three points. A distance of 160 poles was measured down the creek and 40 poles across, including the creek valley and most of the first bench of land on either side, and a careful count of the following kinds of timber with the yield of each taken in feet board measure, viz:

Tulip-poplar, fine yellow,	150,000	Hemlock	25,000
Linden	50,000	White Oak, large and of su-	
Cucumber	40,000	perior quality	20,000
Hickory, fine quality	30,000	Black Walnut, good	3,000
Ash, fine quality,	40,000	Sycamore	25,000
Total for 40 Acres,			383,000

The above make an average yield of 9,575 ft. board measure to the acre.

Measurements of land and timber estimates were also made on several branches of White Oak creek with about the same results.

The timber on the sides of the hills facing southeast is much lighter as the summits are reached; but on the hills facing northwest, the timber, in growth and product, is nearly as good as on the first and second benches, and in many instances very large Tulip-poplar, Linden and Ash trees are found in the gaps of leading ridges, at or very near their summits, and on the most elevated parts of the land.

In arriving at the foregoing estimate it will be seen that no account was taken of Beech, Sugar and Silver Maples, Buckeye, Dogwood, Black Gum, Chestnut, and Chestnut Oak, large quantities of each of which are found quite over the entire tract.

The above estimate of quantities is based upon the timber that has a fixed commercial value, though in conversations with Pennsylvanians connected with coal and timber operations on the property below and adjoining, I learned that they consider Beech the best lumber they can get for the bodies of coal cars, and they have commenced sawing it to use for that purpose; also that quite an enquiry is now being made for dogwood of which there are large quantities everywhere on this land.

After making due allowance for defective standing timber and for lack in quantity on southeastern exposures, I place the entire timber product on the whole tract at 8,000 feet, board-measure, per acre,—including in my estimate only the trees mentioned in the foregoing list. This will give on the entire tract a grand total of 124,256,000 feet of lumber.

The timber on Sang and White Oak creeks can be taken to Coal river by the construction of a railway from the mouth of the former, for a few hundred yards, and from the latter by a railway 3 miles long up from Coal river, reaching the finest undisturbed forest of timber that I have ever seen in the Virginias.

This timber can be safely floated down Coal river to its mouth and secured there by a suitable boom and dam, just as millions of feet have been carried down the Guyandot, for the past half century, to market.

The timber on Cabin creek is now within 4 miles of the present terminus of the Cabin Creek & Coal River Ry., at a point 4 miles below this land. From that point this railway can be very cheaply extended, without having to construct any bridges and with very light grading, to the heart of this timber and coal.

After making various estimates of the cost of constructing roads and of handling the timber from the stump to points where it can be manufactured into lumber,—say at the mouth of Coal river or at any point on the line of standard-guage Cabin Creek & Coal River Ry., I have adopted the following as a reasonable schedule of cost and values.

Value of lumber loaded on cars per M. b. m.		$15
Value of standing timber, or stumpage, per M.	$2	
Cost of delivering logs from stump to railway	4	
Charges for shipping in the log, by railway	1	
Total	$7	
Value of lumber loaded on cars, per M.		$15
*Value of standing timber, or stumpage, per M.	$2	
Cost of delivering logs from stump to railway	4	
Charges for shipping in the log, by railway	1	
Cost of sawing (over the actual)	2	
Deduct 10 per cent for defective and unsalable	1.50	
Total cost per M. on cars	$10.50	
Deduct cost from market value leaving for net profit on each M	$4.50	
	$15	$15

All practical lumbermen will readily concede that the given estimated cost of handling the timber is greatly in excess of the actual cost; this has been made so for the purpose of covering all contingencies.

If the conclusions above arrived at are correct, alike in the quantity of timber and the cost of handling and sawing it, then the value of the timber now standing on this land, in the tree, is $559,152.

I must admit that the above results as to yield of timber greatly exceeded my expectations and caused me to go over my calculations many times to prove their correctness, and I feel warranted in adding that the actual product will exceed my estimate.

*NOTE. The item of $2 for value of standing timber, or stumpage, should not have been added to the cost by Capt. Welch, for the owner of the land is paid for that, therefore $248,512 should be added to the above $559,152, making the realizable value $807,664.

The Crystalline Rocks of Virginia compared with those of New England

By Prof. C. H. Hitchcock, State Geologist, Hanovor, N. H.

Read at Washington Meeting of Am. Inst. of Min. Eng. Feb. 1882.

A brief residence in Virginia has enabled me to examine some of its crystalline strata, and a few hints, concerning their correspondence with similar rocks elsewhere, may be of service to those who are studying them.

In comparing the crystalline rocks of Virginia and New England, we may first recall the similarity of their geological position. They constitute a continuous belt, being traceable through the Highlands of New York and New Jersey, Southeastern Pennsylvania, in the counties of Bucks, Montgomery, Philadelphia, Delaware and Chester, and Maryland. Thus the Green mountains of Vermont and the White mountains of New Hampshire seem to be topographically continuous with the Blue Ridge and Piedmont and Midland districts of Virginia. This tract of country has been termed the *Atlantic* area in distinction from the *Apalachian* territory, whose eastern limit is the great Lower Silurian limestone valley extending from the St. Lawrence and Champlain valleys to Alabama.

The Apalachian formations were studied by the brothers Rogers, forty years since, and found to rest unconformably upon the western flank of the Blue Ridge, the oldest of the series adjoining the gneisses, followed westerly by the other Paleozoic members in a regular ascending order, to which numerical designations were applied—Number I being the Cambrain, Number II the Lower Silurian limestones, etc. In Vermont the same conclusion was presented in the state reports; the Green mountains were said to possess the anticlinal structure, and to underlie the quarzites and limestones. Inasmuch as this Atlantic area is topographically continuous from the Middle to the Northern States, and is unconformably overlaid upon the west side by the same succession of strata, the presumption is very strong that the history of both sections has been the same, and that the entire area is of Eozoic age.

Cross sections, in both districts, illustrate the existence of gigantic overturns, causing the strata of the Apalachian region to dip towards the Atlantic gneisses. To the beginner it would appear that the Silurian groups must dip beneath the crystallines, and hence many of the geologists in the beginning of the study of the stratigraphy of this eastern border of the continent believed that the Atlantic gneisses were newer than Eozoic. Only those who have worked in this crystalline region can appreciate the magnitude of the obstacles presented by the well-nigh universal prevalence of erroneous views. For thirty years an exaggeration of the metamorphic theory spread like a blight over the study of the older rocks. We now understand, both in Vermont and Virginia, that the Potsdam quartzites are newer than the crystalline gneisses to the east of them, both because the fragments of the former have been derived from the disintegration of the latter, and because the discordances of stratification, exhibited at Sunderland, Vermont, and Balcony Falls, (James River gap of Blue Ridge) in Virginia, cannot be otherwise explained. Though long an opponent of this view, Professor Dana now accepts the doctrine of the greater antiquity of the Green Mountain gneisses, when compared with the Potsdam quartzites on their western flank.

While the sequence of the Paleozoic column has been satisfactorily worked out in Virginia, little attention has been paid to the order of the crystalline series. First of all, it became clear that Logan's suggestion of the separation of the Eozoic into Laurentian and Huronian was applicable to the east. This was admitted by H. D. Rogers in 1858, using the terms Hypozoic and Azoic, instead of the geographical terminology. We can now subdivide these groups still further. The proposed institution of a Labrador or Norian system fails, because the rocks, thus distinguished, are of eruptive origin. In New Hampshire we find at least four well-marked sub-divisions of the older series; (1), porphyritic gneiss, (2) protogene or "Bethlehem" gneiss, (3), ordinary or Lake Winnipiseogee, gneiss and (4), the Montalban. In the absence of detailed studies of the typical Laurentian areas it is impossible to know whether similar divisions can be recognized in them. From imperfect data we have concluded that the oldest, and possibly the first three, of the New England groups represent the Laurentian of New York and Canada. The Montalban is more evidently an independent system.

The Green Mountain gneisses are related to the second and third of the New Hampshire series. They are repeated by folds in Southern Vermont, and overlie the porphyritic gneisses along the western border of New Hampshire, in the Connecticut Valley—the older system lying east of the newer one. The same order is perceived along the James River Valley, in Virginia. At Balcony Falls and further east, the gneisses are like those of the Green mountains. Where the Tobacco Row mountain range has been cut through by the James, the porphyritic gneisses show themselves, though not abundantly. Between these ridges an argillitic schist shows itself, which Professor Campbell regards as a part of the Laurentian. As this kind of rock has not usually shown itself so early, I would raise the question whether it will not be found to lie in a synclinal trough—possibly inverted—upon the gneisses, and to be of Huronian or Cambrian age.

This porphyritic rock is not seen in the next section of the Blue Ridge, that along the Norfolk and Western Railroad, to the southwest of Lynchburg. Near the dividing ridge the Peaks of Otter show themselves conspicuously. These so closely resemble some of the New England eruptive granite cones as to suggest a like composition and origin. Quite near them on the railroad I observed a coarse syenite, which may possibly be connected with their mass.

The Huronian seems to occur in long narrow strips, enclosed by the gneisses, and possessing a complex synclinal structure. Where the strata are monoclinal they should be regarded as an overturn synclinal. Typical schists of this system, with the included minerals, are repeatedly described in Rogers' reports. At first it was thought that only the "talcose," or soft greenish hydromica schist with the steatite and sepentine should be referred to this system. But later studies and comparisons make it necessary to add great developments of argillitic

quartzites and mica schist, as well as diabases and protogenes to the softer schists both in New England and Virginia. This step will relieve the otherwise excessive reference to the Cambrain of many unfossiliferous terranes. In New England the softer schists are rarely found east of the Connecticut-Merrimack water-shed. A similar area is that which is crossed by the Virginia Midland Railroad east of Manassas, and to the southwest of Charlottesville. The same or similar rocks are traversed along the Norfolk and Western Railroad, between Lynchburg and Thaxton station. It is also largely developed east of Lynchburg, along the Richmond and Alleghany Railroad.

Another rock, more suggestive of Huronian than any other Eozoic or Paleozoic affinities, occupies the south part of Montgomery county in the gold-region of Brush creek, skirting Pilot mountain—the western fork of the Blue Ridge. The rocks are coarse protogenes, cut by large auriferous quartz veins. It is certainly three or four miles wide, with a less dip to the east than the Cambrain quartzite of Pilot mountain. My explorations did not extend far enough to the east to explore the gneissic rocks of the plateau, which are, probably, Montalban,and connected with the lofty Black mountains of Western North Carolina.

Between Pilot mountain and Christiansburg a great thickness of slates and sparry limestones is exposed, which correspond very closely to the Taconic system of Emmons as developed in Eastern New York and Western Vermont. They are referred to formation No. I by W. B. Rogers.

It would seem probable that the broad Huronian belt between Washington and Harper Ferry, on the Potomac, which continues southwesterly past James River, according to Professor Fontaine, will still be seen to occupy the ground all the way to North Carolina. As the Blue Ridge divides near Roanoke, and the branches extend through North Carolina into Georgia, it will be interesting to know whether the Huronian accompanies the Cambrian slates and quartzites. Inasmuch as copper and gold follow these ranges, the solution of the problem will have important practical bearings, and will also show whether the Montalban is inferior to or superior to the Huronian. Large Laurentian areas may be looked for in the Midland Virginia district.

Notes on the Geology of the Virginias.

Extracts from the manuscript Note Books of the Virginia Survey of 1835-41 by Prof. William B. Rogers.

(Continued from page 194 of Vol. III.)

Formation No. IV—the Levant of the 1st. Pa. Survey Report, the 5a. Medina of the New York Survey, the lowest member of the Silurian (Upper Silurian of some), general group of formations, the one that during the progress of the First Pa. Survey was described in 4 subdivisions, from above down, i. e.: 1. the Medina White Sandstone; 2. The Medina Red Sandstone; 3. The Oneida Red Conglomerate; and 4. The Oneida Gray Conglomerate—is described as follows by Prof. Rogers in the manuscripts for his final report on Virginia geology:

"This is a sandstone deposit 1500 feet in thickness in the northeast.

It consists of brown and gray sandstone; the brown forms the middle and lower parts; and the gray the upper part, with the exception of the east corner of the great Apalachian belt. In the northeast portion of the state we have the following variety in this generally conspicuous formation.—I may say conspicuous because it is this that forms most of the extended mountain ranges in the Apalachian belt.—Of the brown variety there is no striking modification. But as there is a difference in mineralogical character it will be noticed as follows:

First. A somewhat heavy bedded, dark brown sandstone resting upon formation No. III and measuring 300 feet in thickness.

Second. A dark reddish brown sandstone in thinner beds, separated by a little heavy slate; this is 675 feet in thickness.

Third. A dark brown sandstone the beds of which are heavier than the first variety and the material rather coaser; thickness 325 feet.

Fourth. This is the most conspicuous part of the formation, and owing to its position in the formation and the compactness of its massive beds, we see most of this wherever the formation is exposed. The strata of this part of the formation are mostly massive, compact and vitreous. They are—or some of them—slightly conglomeritic. This part of the formation measures from 350 to 400 feet.

In the Massanutton and the mountain ranges to the northwest,comprising what may be termed the east corner of the Apalachians, there is a modification which I believe is peculiar to this region. We have not the thin-bedded, dark brown sandstone here; but instead, a somewhat heavy-bedded mottled gray sandstone, variegated and composed of coarse sand; the texture, in a large proportion, is friable; and much of it is compact and ribboned with blue.—These are the most striking peculiarities of this formation in the northeast and middle portions of the Apalachians.

In the southwest the thickness is very much diminished, but the most conspicuous part of the formation here, as in the northeast, is a heavy band of massive gray strata, the thickness of which is from one-half to two-thirds that of the same band in the northeast. This variety succeeds immediately to the heavy red slate and soft sandstone described as the upper part of No. III. It is remarkable for the abundance of its fossils. It is, as in the northeast, slightly conglomeritic in some beds, and the whole is much vitrified.

Above this part of the formation are strata of brown, red, and variegated sandstone, much thinner than those which precede them. Some of these are exceedingly hard, compact, and vitreous. A heavy bed of arenaceous *iron ore*, very compact and vitrified, occurs among these. This series, which is from 400 to 500 feet in thickness, is terminated by a band of heavy strata that are more conglomeritic than any below. In these much red is mingled with the gray color, causing a variegated surface. In succession to these last follow the red ferruginous strata classed with No. V.—There is some reason for supposing that No. V. should have commenced at the superior termination of the band of heavy strata with which in the southwest we have commenced No. IV. The argument in favor of this will be referred to in the remarks upon formation No. V.

In the counties of Montgomery, Wythe and Giles, No. IV is about 1,000 feet in thickness—measuring all the strata described above. From these counties as we progress southwest we find a gradual diminution of thickness until we arrive at Cumberland Gap, where it is not more than 250 or 300 feet in thickness. In Powell mountain and in the Clinch mountain near the Tennessee line, I suppose it to be from 500 to 600 feet in thickness.

In the extreme southwest, in Lee county, the gray variety of the formation has disappeared, or rather the strata in place

of that have dark brown color. The dark red and brown colors prevail in Powell and Clinch mountains also. There is very little of the gray material even in the very far southwest.

The only fossils in this formation are fucoides, fine specimens of which are generally abundant at all points of the existence of the formation

Formation No. V—described in final report of 1st Pa. Survey as Surgent below and Scalent above, and in the New York Survey, from No. IV up, as 5 b. Clinton, 5 c. Niagara, and 6. Salina—is described as follows by Prof. Rogers:

"This formation consists of slabby sandstone, fissile aluminous slate, calcareous slate with thin beds of impure limestone, and iron ore; forming, all measured, a thickness of from 600 to 1,000 feet.

Immediately succeeding to the most conspicuous—the gray band of massive strata which terminates No. IV, are rather thin bedded, dark red or deep brown coarse sandstone. These are of compact texture and vitreous to some extent. The thickness of this member of the deposit varies from 150 to 250 feet. In it is a thin band of several strata remarkable for its *ferriferous* character, and for the persistency of this feature The thickness of this is generally about 20 feet, it has the compact and vitreous character in a higher degree than the associated beds.

Succeeding is a dark and pale green slate, varying in mineralogical characters—sometimes a heavy and at others a fissile slate, and not unfrequently calcareous with thin beds of limestone. The superior portion of this variety of the formation generally contains a good deal of dark red coloring matter. This division of the formation is sometimes terminated by a thin band of brown sandstone; when this is not present the slate is heavier and coaser. In this part of the formation occurs excellent *iron ore*, a valuable characteristic. We will set this division down as about 250 feet in thickness.

The upper part of the formation consists of slate and thin beds of sandstone, and sometimes we have thin beds of limestone. Dark red coloring generally prevails here, particularly in the northeast part of the state; farther southwest it is not so characteristic, and sometimes the red coloring is almost entirely absent. This division is mostly terminated by coarse material in the shape of thin beds of sandstone, which are remarkable for their fuciodal surface. A little fissile calcareous slate generally succeeds to these beds before we arrive upon the limestone beds of the superior formation. It rarely occurs, although it is sometimes the case, that the terminating band of ribbed fucoidal sandstone is not present or so poorly presented as to almost escape notice.—In the middle portion of the Apalachian belt this terminating band of sandstone becomes largely developed into comparatively heavy beds of brown and gray sandstone,—at least such is the character of the rocks immediately below No. VI. From this part one would seem to be justified in the opinion that what we have described as the upper part of No. IV in the southwest is in truth a superior member of No. V. The band of compact arenaceous iron ore with its associated dark red beds,—and more than all the existence, in this position, of those unique tubulitic strata, which I had forgotton to describe as a characteristic of this formation, strengthens this view very much.

These tubulitic strata are generally brown or variegated, and present the appearance of having been pierced with large holes, at right angles to their surface, which were filled with sand which has become more compact and irresistible than the parent or containing rock; these are made conspicuous by projecting beyond the surface. These cylindric heads projecting beyond the surface vary from ¼ to one inch in diameter. They can be traced by a fracture to the opposite side of the containing structure; but their outline becomes very indistinct, so intimately are they incorporated with the mass. Their great numbers render these curious appearances still more remarkable; they are almost as thick as they can well exist and be distinct and separate.

In the counties of Montgomery, Wythe and Giles there is but an inconsiderable thickness of rock which has generally been considered as comprising all belonging to this formation. This consists of beds having a dark red color, which are slabby and composed of coarse sand. They have a very close resemblance to that division in this formation which has been described as occurring immediately above No. IV. There is a stratum highly ferriferous in them too, which increases the resemblance. But associated with this thin band of red rock, we not unfrequently are presented with excellent *hematitic iron ore*. I have never measured this band, but am of opinion that it is considerably below 200 feet in thickness.

In the extreme southwest we have the deposits Nos. IV and V resolved into their original line of separation. We must there commence with No. V, immediately above the heavy gray band of No. IV; for all above are of a dark red or brown color except the slate, which has a good deal of red coloring matter. The formation in this district contains a very rich bed of *iron ore*, remarkable for its fossiliferous character. The formation in this part of the Apalachians will probably measure 250 to 300 feet.

The fossils in this formation are mostly associated with the iron ore; in connection with this they are frequently abundant in quantity but not in variety.

U. S. Geological Survey of the Virginias.—In response to a letter of inquiry from Senators Davis and Camden of West Virginia, Major Powell, Director of the U. S. Geological Survey, made the following reply.—What he says about the survey of West Virginia applies equally to Virginia, especially to its Blue Ridge, Valley and Apalachian divisions, for this survey will, of necessity, be conducted simultaneously and connectedly over both states, as has been heretofore stated in *The Virginias* in giving and approving Maj. Powell's proposed plan of operations.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY.
Washington, D. C., Jan. 9, 1883.

GENTLEMEN:—I have the honor to acknowledge the receipt of your letter of January 5th, relating to the extension of the geological survey over the state of West Virginia, and to reply thereto as follows:

The present and prospective importance of the mining industries of West Virginia is fully recognized, and already plans have been made for a geological survey so thorough as to properly delineate the great mineral wealth of that region. A geological survey must be preceded by a topographic survey in order that the geological structure of the country may be appropriately represented, and the initiatory work of the topographic survey has already been commenced in the establishment of certain geodetic points and the compilation of the railroad and river surveys of the state.—It is proposed to push the work in the field with all possible vigor during the coming season, and to continue the survey, topographic and geological, until an atlas of West Virginia shall be constructed accurately representing its geographic features geologic structure and mineral wealth. The atlas will be accompanied by descriptive reports. I am glad to be able to respond to your letter in this manner, appreciating as I do the deep interest and efficient part you have taken

in the extension of the geological survey over the Southern Apalachian region. You express a wish for me to take charge, in person, of the field parties making the surveys in West Virginia. This I hope to do.

Thanking you for the confidence implied in your request, I remain, very respectfully,

Your obedient servant,

J. W. POWELL, Director.

To Messrs. H. G. Davis and J. N. Camden,
U. S. Senate, Washington City.

In giving publicity to the above Senator Davis, among other things, wrote as follows, making a good and sensible profession :

This is of great importance to our state It will save us the expense that would attend an effort of the state to make such a survey, and besides it will be far more important, as the men who have charge of the National surveys are better qualified to discharge such duties than any men we could afford, as a state, to employ, and their report will have weight abroad as well as at home, because it will be national and not local.

It is believed a good, careful and complete geological survey of Virginia and West Virginia will show more mineral resources than all Europe. I feel sure this great country of ours, especially the Virginias has a great future ; information, enterprise, and capital are essential to development and prosperity. A country or state, like a corporation, a firm, or an individual, to prosper must be progressive. I would respect and protect with equal care state and national governments. I cannot believe with some Democrats in extreme state rights, nor can I follow many Republicans in centering nearly all power in the national government. I am for letting the dead issues rest and for cultivating the living ones. I favor a fair, just, and living tariff, that will protect equally the people and manufacturing interests. I am for an effort to regain our ocean carrying trade ; we formerly had 75, now 17 per cent. I am for a proper degree of economy in all expenditures of public money and for progress and prosperity of our entire country and people. I would encourage and foster education, and do whatever else will make our whole people and country intelligent, prosperous, rich, happy and great.

The Soapstone beds on the land of O. A. Peerman, 4 miles from Otter station of Va. Midland RR., Campbell county, Va., are now being worked by the Va. Mining and Mfg. Co., of Alexandria, Va. This soapstone quarry has been worked for over 40 years for use in its vicinity, and from the opinion entertained of it from this use it is believed to be equal to that obtained from New England or from any other part of this country. We are pleased to hear from Supt. H. T. Douglas, of this company, that these beds will be worked extensively, and that this Virginia soapstone will be shipped by the Va. Midland RR. to Alexandria, and there sawn into the shapes in demand and sent to the New York, Philadelphia and other markets.

Ochre deposits have been opened by the Virginia M. & Mfg. Co., of Alexandria, Va., on the Wm. Merica land, a short distance below the Furnace No. 2 station of the Shenandoah Valley RR. from Milnes to the Fox Mountain iron ore beds of the Shenandoah Iron, &c. Co. These ochre beds are cut by Naked creek, the line between Page and Rockingham counties, Va.; they are the ochres of the Potsdam, formation No. I, and in the same range as those of the Oxford Co., near Marksville, about 10 miles northeastward from these on the flank of the Western Blue Ridge. There are two varieties of the Merica ochre, a *yellow* and an *orange*. It is proposed to ship these ochres to Alexandria, via the Shenandoah Val. and Va. Mid. railways, there to be ground and prepared for market.

Immigration to U. S. in 1882.—Hon. Jos. Nimmo Jr., Chief of Bureau of Statistics, reports that 712,542 immigrants came to the U. S. in 1882; of these Germany furnished 229,996, England and Wales 77,725, Ireland 69,461, Scotland 16,169, Italy 29,317, Norway 26,185, Sweden 58,742, Dominion of Canada 83,071 and Austria 12,301. New York city received over half of the whole number ; Baltimore was 4th in numbers received, 36,678 landing there.

A Year's Tonnage of Richmond & Alleghany RR.—General freight agent B. S. Barbour furnishes *The Virginias* the data for the following statements of the traffic of R. & A. RR. for the 12 months ending Oct. 30, 1882.—We are sorry the statement does not give the origin and destination of the articles, so we could know where developments are being made and for what purpose.

1. *Metals and Minerals, in tons :*

	East.	West.	Total.
Pig iron	2,897	1,145	4,042
Coal	18,041	3,575	21,616
Salt	39	1,257	1,296
Stone	14,375	6,863	21,238
Iron ore	6,627	20,604	27,231
Totals	41,979	33,444	75,423

In addition to the above 5,724 barrels of cement were moved—4,281 east and 1,443 west; and 50,740 barrels of lime,—45,713 east and 5,027 west. The cement was probably from the works of Messrs Locher at Balcony Falls and much of the lime from Indian Rock. The stone included the Buckingham slates which reach markets by this road.

2. *Live stock :* 82 car-loads moved,—77 east and 5 west.

3. *Forest products :* 854 car-loads of bark,—678 east and 176 west; 2,185 car-loads of lumber,—1,546 east and 639 west; and 2,966,502 pounds of sumac.

4. *Manufactured articles :* 2,032 barrels of whiskey,—243 east and 1,789 west ; 29,723 barrels of flour,—15,858 east and 13,865 west ; and 131,771 pounds of manufactured tobacco,—23,653 east and 108,118 west.

5. *Products of farms*, in pounds :

	East.	West.
Leaf tobacco	6,557,721	404,434
Wheat	12,036,060	660,058
Corn	7,895,219	3,491,329
Oats	891,082	724,164
Rye	15,665	19,262
Forage	3,665,273	2,252,694
Dried fruits	152,101	15,016
Bacon	3,675,955	2,399,189
Butter	13,745	3,753
Eggs	64,288	5,569

These are all good showings, indicative of a prospering traffic business and of a productive condition of the country traversed.

Geological Section at Wheeling, W. Va.—Among the papers of the late Prof. Wm. B Rogers we find the following geological section of Ohio River hills, at Wheeling, W. Va., made by Mr. Briggs and Mr. Townsend. The section is delicately drawn; its contents are thus given, from the surface downward:

No.		Ft.	In.
1.	Limestone and sandstone covered with soil	110	7
2.	*Coal*	3	–
3.	Fire-clay	1	–
4.	Shale and limestone covered with soil	62	8
5.	Sandstone	25	7
6.	Alternate beds of shale and limestone	18	7
7.	*Coal*	2	6
8.	Fire clay	3	6
9.	Limestone and dove colored shale	8	–
10.	Calcareous shale (lower part limestone layers)	21	5
11.	Argillaceous shale	3	–
12.	Pure limestone	2	1
13.	Unknown (Upper part argillaceous rock)	6	8
14.	Compact gray limestone (The purest in the hill)	0	9
15.	Calcareous and argillaceous shale	7	7
16.	Olive sandstone (Making excellent whetstones)	7	–
17.	Yellow argillaceous limestone	12	–
18.	Ash colored and blue limestone	4	2
19.	Slaty sandstone	1	7
20.	Yellow argillaceous limestone	5	–
21.	Compact gray limestone	2	7
22.	Yellow marly limestone	11	8
23.	Compact limestone	4	2
24.	Olive green shale	3	10
25.	Bluish marly limestone	21	–
26.	Blue and dark colored limestone	1	6
27.	Bluish limestone	1	2
28.	Brecciated limestone	0	10
29.	Bluish limestone	2	–
30.	Alum slate, micaceous	9	–
31.	*Coal*, poor, and shale	1	–
32.	Blue limestone (Briggs made 2 beds of shale 8′ and 7′)	13	4
33.	Slaty micaceous sandstone	8	–
34.	Bituminous shale with 1′ of poor *coal* (Fern impressions)	6	9
35.	Magnesian limestone (Dwindling to about 4′ at Brownsville)	13	–
36.	Shale containing a little lime	0	3
37.	Main bed of limestone	40	–
38.	Impure fire-clay	4	–
39.	*Coal* 1′ 0″ Shale 1′ 0″ *Coal* 5′ 4″	7	4
40.	Fire-clay	3	–
41.	Shale with nodules of limestone	5	–
42.	Shale, bluish, sandy	16	–
43.	Main building sandstone	26	–
44.	Bluish clay (shale) micaceous Reddish brown shale, hard calcareous, Ferruginous nodules Bluish, slaty clay; fern leaves Bluish, slaty calcareous sandstone	17	–
45.	Hard gray limestone, sub-crystalline, a few organic remains		(?)
46.	Variegated calcareous shales, purple, red, green and yellow Light olive green shale to bed of Ohio river	68	4

At Freeport, Ohio, 130′ (?) under the level of the Ohio is a 4′ bed of fossiliferous limestone.

Comments on above Section by Prof. I. C. White.

Maj. Jed Hotchkiss:

My dear Sir:—The geological section at Wheeling, W. Va., taken by Messrs. Briggs & Townsend under the direction of the late Prof. Wm. B. Rogers, and sent to me by you for classification and comment, is herewith returned, together with a few remarks on the same.

The value of this section is very great, for it was evidently made with great accuracy by means of the *spirit level*, at a period so early in the history of the city that the complete exposure of the rocks was then obtainable. Much of the section, plainly visible at that time, is probably now hidden from sight by vast heaps of rubbish—cinder and slag—the waste products of Wheeling's famous industries. Through this splendid section, however, made by men who had been trained to habits of accuracy and keen observation under their immortal Chief, Prof. Rogers, the rocks of Wheeling's hills, though covered from view in some portions, stand out before the eye of the geologist with a boldness equaled only by the bluffs that surround that busy city.

The 7′ 4″ coal bed, No. 39, in the lower portion of the section, is the famous *Pittsburg vein*, and the basal member of Prof. Rogers' No. XV, or the *Upper Coal measures* of other authors. It is the same bed that extends along the Monongahela river from its mouth nearly to its source, and from which the heavily laden coal boats that so often float past Wheeling's doors are filled. From this same bed in Fayette and Westmoreland counties, Penn., the Connellsville coke is made. The Fairmont, Newburg, Piedmont, Elk Garden, Lonaconing and Frostburg mines are all principally in this bed. It is to this one member of the section that Wheeling owes her world-wide fame as the Nail city; had it been absent from the section, the manufactories that have rendered her the metropolis of our state, would have been unknown within her limits.

The Redstone coal is represented by the 1 foot of "poor coal" in No. 34, at 57′ above the *Pittsburg bed*. It seems to be quite irregular and uncertain in the vicinity of Wheeling, but on the opposite side of the river, in Ohio, it has occasionally been mined, and is known as the "Jumping 4′ seam" from its irregular thickness, (Stevenson). In Monongolia county the *Redstone coal* is 4′-5′ thick, quite good, and 40′ above the Pittsburg seam.

The Sewickly coal is represented by No. 31 at 85′ above the Pittsburg, only 1′ thick and very poor coal too. In Monongolia county this bed is 5′-6′ thick, and one of the finest grate coals in the state. It is found there at 90′-100′ above the Pittsburg coal

The 2′ 6″ coal, No. 7 of the section, has been identified by Dr. Jno. J. Stevenson, Prof. of Geology in the University of N. Y., as the *Waynesburg coal* of the Penna. series, and accepting it as such, this would be the highest bed of the Upper Coal measures, No. XV. The only reason for casting any doubt on the correctness of this identification is the fact that No. 7 comes only 250′ above the *Pittsburg bed*, while the *Waynesburg coal*, all along the Monongahela, comes 360′ above that seam, and in this Wheeling section a coal, No. 2, is found at exactly the same horizon (360′ above No. 39). This of itself is sufficient to raise a doubt, and when it is added that *a coal bed*, the *Uniontown*, occurs in Fayette and Washington

counties, at 90'-100' below the Waynesburg bed (or about the same distance that No. 7 is below No. 2), the doubt is not lessened, to say the least.

On the other hand it is well known, as Prof. Stevenson was the first to demonstrate, that the intervals between the important coal beds, both of the *Upper* and *Lower series*, decrease regularly westward when followed into Ohio, and this fact would favor the correctness of his identification; but the exact coincidence of No. 2 in elevation above the Pittsburg bed with that of the *Waynesburg* further east, is sufficient cause for doubt until some one can trace the Waynesburg bed and its associated rocks from their outcrop near the Pa. line, on the Washington Co. Br. of the B. & O. RR., westward to the Wheeling hills, and thus prove, beyond question, which of these beds (No. 7 or No. 2) is the representative of the *Waynesburg coal.*

Should it prove to be No. 7, then all the beds above (221 feet) would belong to the Permian, No. XVI, but if No. 2 should be the *Waynesburg*, then would the base of the *Permian beds* begin with No. 1 of the section.—Hence with our present knowledge the section may be classified as follows:

Barrens (XIV), Nos. 40 46		135′	4″
Upper coal measures (XV),	Nos. 7-39	259′	8″ (?)
	or		
	Nos. 2 39	375′	6″ (?)
Permian (XVI), ...	Nos. 1-6	221′	5″ (?)
	or		
	No. 1 . . .	110′	7″ (?)
Total height of section		616′	5″

Yours very truly,

W. Va. University, Jan. 6, 1883. I. C. White.

Norfolk & Western RR.—The gross earnings of this road during the year 1882 were $2,429,740,—a gain of $160,452 over those of 1881; the expenses were $1,322,577, an increase of $166,144 over those for 1881; leaving the net earning $1,107,163, or $3,692 less than they were in 1881.

At the recent annual meeting of the stockholders of this railway, held at Norfolk, the following officers for 1883 were chosen: George F. Tyler, president; F. J. Kimball, first vice-president; Henry Fink, second vice-president; Wm. G. Macdowell, treasurer; C. R. W. Armes, secretary; E. E. Portlock, auditor; W. J. Robertson, general counsel; Joseph I. Doran, solicitor; John W. Brock, assistant solicitor; and Clarence H. Clarke, George F. Tyler, F. J. Kimball, Edward A. Rollins, John C. Bullitt, James A. Scott, William B. Isham, George C. Clarke, R. B. Minturn, Upton L. Boyce, John B. Whitehead, J. Arthur Johnson, and Charles Hacker, directors. Authority was given the directors to unite with other roads in making an extension of its lines to the northwest,—which means that the New River branch may be extended from Flat-top (Pocahontas) down Big Sandy river to a connection with the Chattaroi RR.

The New River branch of this railway was opened to business from New River station of N. & W. to Wenonah, the station for Pearisburg, a distance of 28 miles, on the 22nd instant.

A construction and wrecking boat is one of the wants of the Great Kanawha. Capt. E. H. Ruffner of the U. S. Engineers, in a letter to *The Tribune* says:

In my opinion there is a field for the employment on the river of a construction and wrecking boat. A well-made flat, say 25x60 feet, with gunwales stripped by a low truss, to stand the downward thrust of the legs of a stiff derrick at one end; equipped with a small hoisting engine so as to apply power to the derrick or to a pile driver, or to capstans which should be at either end of the boat, would answer the purpose admirably, and would not be expensive. To make the apparatus complete, there should be also at least one pump which could be attached, if needed; and of course if there were a diving suit belonging to the establishment the value of the whole would be much increased. The last item is expensive and needs care, and it is not often called for, but when it is wanted is very much wanted. Such a boat could be made use of in the building of all constructions in water, and would be of great help in all cases of wreck and of badly leaking boats. For $2,500 I should think such a boat could be put up complete, provided some suitable second-hand machinery could be got, and could be easily towed from place to place by the smallest boats operating on the river.

The Weight of a Cord of Oak Wood, of standard average, has been fixed by the Quartermaster General of U. S. Army, after careful study and consultation of different authorities, at 3,195 pounds.

Rules for burning Coke.—A recent report on coke and its value, concludes as follows: 1st. The size of coke used should be a size smaller than that of anthracite for the same purpose. 2d. Fires should be made deep and broad, and after coke catches all drafts should be checked (at night entirely, in most cases.) Care must always be taken to keep the supply of coke large, as fire will not be held except in deep bodies of coke. 3d. The ashes from coke are a white powder, and free from clinkers, those from coke should contain no slate or waste.

Physical science, in the opinion of Renan as expressed in his autobiography, will be the principal study of mankind a century hence, and the historical sciences will be thrust into the background. The more men know of nature the more they find that they do not know, and the search after these unknown truths will be more attractive than any other study.

Kaolin for porcelain making must be very pure and especially free from iron, as the smallest particles of that stain the white of the wares made, hence deposits of genuine porcelain clay are rare, for most clays are stained by iron. Recently electricity has been successfully employed in purifying such clays, the liquid paste being brought in contact with the poles of powerful electro-magnets that attract the ferruginous particles to themselves and so cleanse the clay.

Ship-building has been revived at Yorktown, Va., a 3-masted center-board schooner 122 ft. long, 34 ft. beam and 11 ft. deep having been completed and recently launched there. Its cost was $30,000, one-fourth less than it could have been built for in New York.—A similar vessel is being made at West Point.

The Virginias.

No. 38. Vol. IV.—No. 2.

Staunton, Va., February, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

Errata.—The word "January" was omitted between "during" and "1883" in the heading of the last article on page 25. In the same article the figure "7" is to be supplied to tons of "New River, &c." moved in Jan., 1883, making the quantity 31,237.—On page 30 the word "*tulipifira*" should be *tulipifera*.

The Index and Title-page to *The Virginias* for 1882 will be sent to all subscribers with the next (March) number.

The Mutual Life Insurance Co. of New York, presents in our advertising columns its annual statement. This great institution now has assets amounting to $97,961,317.72 and a surplus of over $12,000,000. It paid on policies last year $12,843,835, a considerable portion of which sum went directly to widows or orphans, in many instances redeeming homes from absolute desolation. The Mutual Life Ins. Co. differs from other Life Co's. in that it never encourages speculation in insurance; never solicits the insured to take a larger policy than he can afford to carry. It has materially reduced its premium rates and in every feature of liberality and safety it stands without a par in this or any other country. The report will well repay perusal.

Lead Ore.—A correspondent asks if lead ore in paying quantity has ever been found in formations V. or VI. in Va. or W. Va.—We have never seen or heard that it has. If any of our readers knows of any deposits in these formations we hope to be informed of them.

Wise county, Va., Coke.—The "Bristol News" states that Supt. Oliphant, of the S. Atlantic & Ohio RR., recently shipped some coal from the 8-ft. bed near Stone Gap, Wise county, to Connellsville, Pa., where it was coked, and that by analysis the coke made from it contained 2 to 3 per cent more carbon and less ash than that made from Connellsville coal.

The Cost of Making Pig Iron in the South.—The Baltimore Manufacturers' Record of March 1, under the heading of "How Much Does it Cost to Make Pig Iron in the South," comments as follows:

The question of the cost of making pig iron in the South is being very generally discussed by the press, and it seems to be almost everywhere admitted that the cost is so much lower than in other sections of the country as to make the gradual movement of the iron-making centre from the North to the South an absolute certainty. But how much lower this cost is, there seems to be some difficulty in finding out. Some of the iron makers of Birmingham, Ala., claim that the difference is comparatively so small as to be fully counterbalanced by the greater distance from the consuming markets, and the consequent higher freights paid. According, however, to the "Review," of Roanoke, Va., this is not the case in that section of Virginia at least, whatever may be true elsewhere, The "Review" says: "Parties owning mines can put ore down at the furnace for $1.75 per ton; it requires two and one-eight tons of ore to make one ton of pig iron. Thus:

Two and one-eight tons at $1.75 per ton	$3.75
Sufficient limestone for fluxing	1.00
Labor and stores	2.00
Coke	3.75
Total cost of pig iron per ton	10.50

Estimating the value of the plant at $400 000, and allowing seven weeks in the year for stoppages, the product would be 24,300 tons of pig iron per annum. The freight to Philadelphia by rail, three dollars per ton, and the commission for handling is fifty cents, making three dollars and fifty cents, which, added to the cost of manufacturing at Roanoke, would make it cost the manufacturer only $14.00 shipped to Philadelphia, where the lowest iron is quoted at $20.50 per ton, and the average price is $23 per ton. This gives to the iron manufacturers of Roanoke a clear profit of from $6.50 to $9.00 per ton; or to each $400,000 plant a profit of $219,510 per annum, which is fifty-five per cent on the capital invested.

These figures, says the editor of that paper, are not mere theoretical suppositions, but are carefully compiled estimates substantiated by Mr. William Tait, a gentleman of long experience in the iron business, both in this country and in Europe; and while the cost of the coke is put down at $3.75, yet it can be had at $3 per ton.

Danville & New River RR.—Contracts have been made that will insure the completion of the extension of this road from Martinsville, its present terminus, to Patrick C. H. during this year.—Maj. W. T. Sutherlin, President of the railway company, has purchased the rails for this extension.

The Chesapeake & Ohio Refrigerator Line, as we learn from "The State," is having 300 cars built to run over the C. & O. system of railways, now extending east and west from the Atlantic to the Pacific and southward to the Gulf, for the transportation of perishable goods,—meats, fruits, vegetables, wines, etc,—by fast trains. One of these cars, now in Richmond, weighs 32,000 lbs and cost $1,100.—M. S. Foot is the Richmond agent.

The Signal Weather Service has been of incalculable value to this country. Its forecasts of the weather have been remarkably accurate, as the writer well knows from a constant study of the weather maps, from their first appearance, and a careful noting of the simultaneous local conditions; therefore we are surprised to see so many papers quote freely from a recent speech by a Pa. Congressman abusing this service and its work. His statements show on their face that he knows but little concerning the work of this bureau and still less about meteorology in general. We can only call attention to one of his arguments. He says, "England contents herself with a moderate weather service" though she has a grand navy and vast commerce, etc. He does not seem to know that England cannot possibly have a weather service of much value, because of her insular character and position towards the ocean from which the "weather" comes. We can and do have hours and even days notice of the approach of storms from the westward. England only knows of westward storms when they burst upon her shores and strew them with wrecks. She would pay ten times the cost of such a service as ours if she could have it.—The silliness of this man reaches a climax when he suggests that the "Western Union" will run the weather service for $200,000 a year! No doubt it would be glad to do so—and run it in its own interests.

All that the present organization needs is more means, to enable it to add stations necessary to give completeness to its observations. It has done and is doing well a vast amount of good work, and we hope our Virginia editors will help to build it up rather than aid in destroying it. We know they will be for it if they will inform themselves concerning it.—Virginia and West Virginia would be greatly benefited by having ten additional stations; it is not the fault of the bureau that they are not in operation now.

The Liberty and Columbia Manufacturing Co. is the name of the new organization that has become the purchaser of the Liberty and Columbia furnaces and estates in Shenandoah county, Va., for the sum of $250,000. One of the principal parties in this purchase is Mr. Samuel G. Merrick, of Philadelphia. It is understood that Mr. Jacob Wissler goes into the new concern as superintendent.—About 3,000 tons of charcoal pig, the product of these furnaces, is now piled up at Edinburg and Woodstock stations of the Valley branch of B. & O. RR.

This company, as a matter of necessity, must at once connect its ore beds and furnaces by a branch railway to a junction with either the Baltimore & Ohio or with the Virginia Midland. Viewed from a business stand-point, it seems to us that the sensible thing for it to do is to construct an iron-belt railway from Liberty furnace northeast, by way of Van Buren furnace and the valley of Cedar creek to both of the above named great railway systems, at or near Strasburg, and so not only secure to itself the transportation of a longitudinally traversed belt of iron ore from 20 to 30 miles long, but also a healthy competition to markets by having a connection with each of these railways. There is no reason why this should not form a part of the line of the projected Coal & Iron RR. that was so fully treated of in our May, 1882, number.

Quinnimont Furnace, and its coal lands, coke works, etc., on Chesapeake & Ohio Ry., Fayette county, W. Va., was sold Jan. 25, 1883, for $150,000. It was purchased by Ex. Gov. J. F. Hartranft, of Philadelphia, Pa., for the first mortgage bond-holders of the Pa. and Va. Iron and Steel Co.—No change takes place in consequence of the sale; Maj. J. F. Lewis continues as manager; the furnace remains in blast, doing good work.

Blue copies of drawings may be altered, says Prof. C. Whitaker, by writing on the blue ground with an ink made of gum arabic and bicarbonate of soda. He also says that copies for shop use should be varnished with a solution of white shellac in alcohol.—*Cotton, Wool & Iron.*

The Ensign Manufacturing Company, Huntington, W. Va., has fired up its new cupolas and has put a force of molders in its new foundry. These additions more than double the foundry capacity of these works. They are now shipping about 45 new cars to their customers every week.—*Argus.*

"The Virginias.—Among the many magazines issued, the bulk are passed over with a momentary satisfaction, and that is all. Those which are of a permanently interesting character are few and far between.—*The Virginias* (Old Virginia and new Virginia,) edited by Maj. Jed. Hotchkiss, of Staunton, Va., is one of the substantial serials. It is devoted wholly to the development of the industries of these states. It seems that no one who has either direct or indirect interests in the two Virginias, but will profit by reading it."—"The Gardener's Monthly," Philadelphia, Pa., for March, 1883.

Dr. Henry Frœhling, of Richmond, Va., has made an engagement to do the chemical work of the Iron & Steel Association of Virginia, for the present at his laboratory, in Richmond, but we suppose he will eventually locate at Victoria furnace. He continues as chemist to the R.& A., R. & D., C.& O., and S.V. railways —It will be a good thing for Victoria furnace and for the Virginias to have such an analyst as Dr. F. constantly occupied in chemical work on our ores, coals, etc. His laboratory, at the corner of 12th and Cary streets, is probably the best equipped private one south of Philadelphia

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Norfolk & Western R. R.—A circular of 2d inst., from Treasurer Wm, G. Macdowell, informs us that the gross earnings of this road for January, 1883, were $200,487; expenses $122,603, and the net earnings $77,884, being an increase of $9,841, as compared with the corresponding period of last year.

At a recent meeting of the board of directors of this company in Philadelphia, it was decided to be inexpedient at present to declare a dividend, the company having need of considerable money to complete its betterments and improvements, and to provide additional rolling stock.

A New Daily Train has been put on the Ches. & Ohio Ry. between Richmond and Newport News and Old Point Comfort, one that will make connections North and West. It leaves Richmond 8:20 A.M., reaches Old Point 12:10 P.M.; returning, leaves Old Point 12:45 P. M., reaches Richmond 3:35 P. M., connecting with the 4 P. M. fast train west.

The Maps of the Apalachian Division of the United States Geological Survey will be made on sheets 13 by 17 inches in size, each covering a square degree of the surface of the country; their scale will be about 1–240,000 th of nature, or 4 miles to one inch, as we learn from Chief Geographer Gannett, of the Survey.

Pig Iron at $21 a ton pays no profit to the Pittsburg manufacturers, says a dispatch of Dec. 26th, 1882, to the Wheeling "Register." It also states that it costs from $6 to $10 a ton to convert pig iron into castings, and that a ton of pig at Pittsburg is 2,268 lbs, while in the East it is only 2,240.

SUPPLEMENT
TO NO. 38
of
"The Virginias",
Feb. 1888.
Topographic Sketch,
Showing Location, Etc.,
OF THE
St. Mary Iron Lands,
Augusta County, Va.
Embracing 10,077 Acres.
By Jed. Hotchkiss, T.E.
May, 1870
Feb., 1888
(The "squares" are square miles.)
Autographed
by Jed. Hotchkiss
Feb. 1888
Valley Branch of Balt. & Ohio R.R.
South River of Shenandoah
Water Tank
Greenville
Greenville St.
Love Run
Maple Ponds
Stony Run
Junction Valley Turnpike
Shenandoah Valley R.R.
Pine Run
Deep Run
John's Run
THE ST. MARY IRON LANDS
South River
Mine Ore Bank
Rock Sp.
Lofton St.
Co. line
Midway
Steele's Tavern P.O.
Plow Factory
Big St. Mary
Cotopaxi
Furnace
Kaolin
Black Rock
McCormick Ore Bank
Fauber Manganese Mine
Rawlings Store
Augusta Rock
Vesuvius
Old Fce.
South River
Zink Gap
Nelson County
Blue Ridge
Traces of Ore.
BARE MN.
LIT. BALD MN.
BIG LEVELS
Bare Bank
Geological Section No. 1. — From Bare Ore Bank through Big Levels.
Indications of Ore
BARE MN.
South Riv.
Mine Bank Basin
Geological Section No. 2. — From 1½ Ms. N.E. of Cotopaxi Fce., Cutting near Mine Bk.
Geological Sections
Made by Prof. J. L. Campbell
June, 1882.

Victoria Furnace, of the Iron and Steel Works Association of Virginia (limited), located at Victoria, near Goshen station of Chesapeake & Ohio Ry., in the valley of Big Calf-pasture river, Rockbridge county, Va., has had drying out fires in the one of its great furnaces that has been completed for some time; it will blow in some time in March. Its output will add fully one-third to the present daily production of pig iron on the C. & O., in the Virginias, making it from 330 to 360 tons a day, or not far from 100,000 tons a year.

Recent Analyses of Iron Ores from Roanoke and Botetourt Counties, Va., made by Dr. Henry Frœhling, Analytical Chemist and Assayer, of Richmond, Va., for *The Virginias*, under date of Jan. 20, 1883, gave the following results.—The samples were dried at 212° previous to analysis:

	No. 1.	No. 2.
Iron bisulphide	None.	Trace.
Iron protoxide	0.045	0.036
Iron sesquioxide	80.103	82.270
Manganese sesquioxide	0.485	0.981
Aluminum sesquioxide	0.647	0.413
Lime oxide	0.593	0.528
Magnesia oxide	0041	0.263
Phosphoric acid	1.1855	0.834
Sulphuric	0.0106	0.049
Silica	9.910	4.570
Water	6.431	9.507
	99.4511	99.451
Metallic iron	56.107	57.817
Metallic manganese	0.337	0 683
Phosphorus	0.5167	0.3634
Silica	9.910	4.570

No. 1. Ore from the "Turner" beds of Rorer Iron Co., from lands purchased of Gideon Turner, Esq., about 6 miles S. of Roanoke, Roanoke county.

No. 2. Ore from the "St. Clair" beds, in Botetourt county, recently sold by Capt. F. J. Chapman to parties from New York.

	No. 3.	No. 4.
Metallic iron	39.40	61.246
Phosphorus	0.4482	0.9439
Silica	40.48	1.606

No. 3. Ore from "Simmons" beds of Mr. P. H. Rorer, near those of Rorer Iron Co.,—a specular magnetic ore.

No. 4, Ore from "Gale" beds of Rorer Iron Co.,—those from which came samples analyzed by Prof. McCreath, and published in our No. 37.

Sinking Creek furnace, Giles county, Va., recently went out of blast, having made about 1,500 tons of charcoal pig iron in 1882, mainly from "red shale" ore.—We see by a notice in the "Roanoke Bulletin" that this property is offered for sale.

The Soldenhoff-Coppee coke ovens, that *The Virginias* first called attention to in 1881, by stating that the Hawks-Nest Coal Co. proposed to construct such to supply the Virginia Iron and Steel Association with coke, are now completed and in operation. Financial Agent Wm. N. Page, of the Va. I. & S. Asso., writes us, under date of 5th inst., "that the ovens are working beautifully, and so far exceed my anticipations both in quality and quantity of coke made."—We intend to visit these coke-works in time to give a full description of them in our March number.

Staves are being cut at the rate of 12,000 to 15,000 feet a day, by Breeden & Bro., on Jennings creek, Botetourt county, Va., says "Buchanan Democrat."

Report on the Mineral Prospects of the St. Mary Iron Property.

By Prof. J. L. Campbell.

(Illustrated by Map and Sections.)

This extensive tract of 10,077 acres lies near the southern corner of Augusta county, Va. It is chiefly mountainous, and is embraced within the northwestern belt of the Blue Ridge range, which has long been famous for the quantity and quality of its Brown Hematite ores. This part of the range is made up of two or three lines of broken ridges composed of alternating strata of sandstones and shales or slates. The iron ores are found imbedded in these strata with considerable regularity, especially in the one from which the largest quantities have been mined. The rocks that constitute that portion of the range with which we have to deal in this discussion, belong to the lowest fossiliferous rocks, forming what is known as the "Primordial or Cambrian period" in geological history; or No. I. of Prof Rogers' Apalachian series.

The real character and value of this property will be best understood by a brief presentation—(1st.) of its topography, and (2nd) of its geological features.

1. Topography.—Its area was traversed by me in several directions, in company with gentlemen well acquainted with the region in which it lies, and, in addition to this, I took a general view of its surroundings on all sides, except a small portion of what borders on the line of Nelson county, wehre there is little if any probability of finding iron ores.

The region known as Big Levels is partly within the limits of this tract. It is an elevated plateau formed by an expansion of the heavy bed of Primordial sandstone that constitutes the frame-work of Bare mountain that borders it on the N. W. It is the great water-shed between the South river of the Shenandoah of Augusta county, and the South river of the James of Rockbridge. This was undoubtedly once covered by the iron-bearing shales that now skirt the northwestern flank of the mountain, but the shales and ores have all been swept away as indicated by the dotted line extending across it on Geological Section No. 1.—The irregular depression that runs off from Big Levels toward the southwest. and forms the valley of Little South river, holds the last remnant of what was once an extensive ore-field, limited now to the little basin of the "Mine Ore banks," as marked on the map.

Along the crest of Bare mountain are several depressions caused by the erosion of ponderous beds of Primordial sandstones. In these the rocks of the next lower bed are exposed, and are found to bear decided indications of ore, but not anywhere developed in such quantities as to promise very profitable results from mining. One of the localities is found directly above the head-waters of Love run. These same rocks, on the neighboring Vesuvius property, carry a heavy bed of ore, but there is only a faint prospect of its extending into this property

While the iron-ore-bearing rocks cover the greater part of the surface of this tract, as is also the case with all the large surveys along the Blue Ridge belt, there are still two areas within its borders that are very favorably situated geologically for producing large quantities of iron ores, and judging from openings that have been made, both on this tract and near its borders, we find good reasons for believing that future and more systematic mining will be rewarded with profitable results.

The accompanying sketch map was constructed by that skill-

ful topographer, Maj. Jed. Hotchkiss, of Staunton. It is therefore assumed to be correct, at least in its general features. On it I have located in red color the out-croppings of ore beds—those that have been actually exposed or mined being represented by continuous lines, while their extensions, as indicated by the geological features of the region and by scattered fragments of ore, are represented by broken lines. These occupy the two areas referred to above.

First Area.—This lies along the N. W. slope of Bare mountain—usually extending to high points on the spurs which flank the main ridge. The demonstrated extent and richness of this bed is found in what is known as the "Bare bank" From this considerable quantities of ore were taken in former years to supply the old Cotopaxi furnace—the ore being so highly esteemed for both the quantity and quality of the iron it produced, as to bear transportation about five miles on wagons

The same ferriferous shales that contain this ore bank extend far beyond the bank both northeast and southwest as may be seen on the map. The range towards the S. W. seems to extend with more or less uniformity from the Bare bank through the Cotopaxi or Morrison bank to other old mines still farther in the same direction. Topographically this whole area is favorably situated for conveying the ores to the Shenandoah Valley Railroad by a descending grade over a distance of not more than two or three miles.

Second Area.—The second ore-bearing area is topographically quite different from the one just described, and yet we shall learn presently that it is in the same geological subdivision of these old Cambrian rocks. It is the extension of the Mine banks on a 47-acre tract, embraced within this survey, and said to belong to Isaac Newton, Esq., of Greenville. It is high up in the valley of South river of Rockbridge. The same geological features as those surrounding the Mine banks were traced for at least a mile beyond the limits of the 47-acre survey; and throughout a considerable portion of the distance, fragments of good ore, and other favorable indications were discovered.—Of course the real extent of the ore beds here can be determined only by cuts or tunnels, but the indications are sufficiently favorable to justify labor and expense enough to fully satisfy all doubts on the subject. Ores from this region can be brought down the South River valley to Cotopaxi furnace, or to the Shenandoah Valley RR. by a descending grade, steep at first, but moderate through the greater part of the distance of about 4 miles to the railroad.

2. *Geology.*—The relative position of the ore beds under consideration with reference to the other rocks of the region will be readily understood by an examination of the profile sections accompanying the map.

Conceive a vertical plane cutting Bare mountain and its adjacent territory transversely, along the line A–B of the map. The edges of the rocky beds thus cut, and projected upon the surface of the cutting plane, may be regarded as pictured on Geological Section No. 1. The dotted bands represent strata of sandstone, the ruled bands strata of shales (or slates), and the *red bands* represent beds of iron ore. The numbers and letters, 2a., 2b., 2c., mark the geological sub-divisions of this part of the mountain range. It will be seen that Bare mountain is capped with a great arch of sandstone, rising from the limestone valley on the N. W. and carrying the Primordial shales with their iron ores high up against its N. W. abutment; while its S. E. leg sinks but a few hundred feet before it stretches across the Big Levels plateau, giving it a covering of heavy sandstone that gives no promise of yielding iron ore.—This sandstone is everywhere characterized by peculiar stem like fossils supposed to be old worm borings made when the mass was a bed of soft sand and subsequently filled up and indurated.

Geological Section No. 2 cuts the same general range of mountains along the line C–D, where the N. W. portion of the Big Levels has risen to the general level of Bare mountain, and the S. E. portion has sunk to a trough-like shape—the valley of South river—and retained a portion of the ancient covering, the ore-bearing bed of 2c., which has been swept from the greater part of the chain of mountains as cut by the two sections before us. This residue is now Mine bank basin. It is altogether possible that this trough of ore may be found to extend across the river towards the N. W., but we found the region too much obscured by a heavy undergrowth to allow any satisfactory explorations. This area could be explored satisfactorily if burnt over after the falling of the leaves. The region about Mount Torrey furnace, on the opposite side of the Big Levels, may be regarded as occupying the same general range as the isolated ore-field of Mine bank basin.

This brief discussion will enable the reader, with the map and sections in hand, to form a correct judgment of the position and extent of the available ores on this property. He will see, from what has been done about Cotopaxi and Mount Torrey, that the same ranges of ore here promise good results whenever subjected to more extended and systematic mining than was practiced in olden times.

The contiguity of other and smaller iron properties that have been incidentally mentioned above, and the fact that some of these are in market, would enable the purchaser of this tract to add some of these smaller areas, and thus not only enlarge his ore-field, but at the same time secure geographical connection between the two ore-bearing areas of this property.

The nearness of this property to the Shenandoah Valley Railroad, gives it a value that it never could have attained without the facilities for transportation thus secured. Convenient sites for furnaces may be readily procured near the line of the road, to which the ores and limestones abounding in the neighborhood, and coke from West Virginia or Pennsylvania may be readily brought together for the manufacture of iron on any desired scale.

Moreover the splendid agricultural region traversed by the railroad will always supply an abundance of whatever is wanted as food for man or beast at the minimum market prices.

Timber.—The timber on this property is ample for all ordinary purposes. In case the owner should desire to manufacture charcoal iron, the supply of coaling timber on the place could be readily supplemented from the adjoining lands to a sufficient extent to run a charcoal furnace for many years.

J. L. Campbell,
Washington & Lee University, Prof. of Geology.
June, 1882.

Virginia Iron Ores and the Tariff—In a recent debate on the tariff, in Congress, on an amendment increasing the duty on iron ore, including pyrites, to 60 cts. a ton, Hon. George D. Wise, representative from the Richmond, Va. district, urged that there should be duty enough to protect American labor from injurious competition with that of other countries. He alluded to the vast deposits of iron ore and other minerals in Virginia, and said these only needed the magic touch of capital and labor to make Virginia one of the richest and most powerful states in the Union. Foreign ores were not needed to mix with ours, even for making Bessemer steel, as we had ore in Virginia or in others of the states suitable for making such steel. He noticed the fact that labor in Spain and Africa, from which we now chiefly import iron ores, is only 35 cts. a day, and he was unwilling to have Virginia operatives in iron mines brought into competition with such poorly paid labor.

Notes on the Mineral Deposits at Certain Localities on the Western Part of the Blue Ridge.

By Wm. M. Fontaine, Professor of Geology in the University of Virginia.

The writer, in the months of May and June, 1881, assisted for a portion of the time by Mr. H. F. Reid, of Baltimore, made a somewhat detailed examination of the geology and mineral resources of the belt of country forming the western slope of the Blue Ridge and the immediately adjoining territory on the west, in the interval extending from Turk's Gap to Balcony Falls. Turk's Gap is in the Blue Ridge, 7 miles northeast of Waynesboro, the junction of the Chesapeake & Ohio and the Shenandoah Valley railroads. Balcony Falls is situated in the Blue Ridge where the James river passes through it. The distance between these points is about sixty miles.

In the month of July of the same year, a re-examination of the same region was made with the additional assistance of members of the class in geology at the University of Virginia. In this re-examination especial attention was paid to the geology. A large number of detailed sections was carefully made across the junction of the lowest Paleozoic rocks with the Azoic strata of the Blue Ridge. This was done with the design of determining the character and subdivisions of the lowest Paleozoic or Primordial strata, and especially of fixing upon some reliable evidences which might indicate to the observer when he has before him the one or the other of these formations.

This work was carried on under the auspices of the Board of Visitors of the University of Virginia, for the purpose of throwing additional light on the resources of the state, and also of enabling the students in the geological class to learn the methods of practical work in the field.

The publication of the report as a whole has been unavoidably delayed. It is desirable to present to the public, as soon as possible, at least that part of the report which deals with the minerals of economic value. Accordingly this portion has been extracted for publication in *The Virginias*. As however the description of the mineral deposits would not be intelligible without some notice of the geology, a brief description of that is added.

The Blue Ridge range, between Turk's Gap and Balcony Falls, is composed of several more or less parallel and continuous ridges that are usually placed close to each other. The ridges rise higher, and the mountain belt becomes broader, as we go south. At least three distinct series of rocks enter into the composition of this range. The oldest of these, and that which consequently occupies the lowest geological horizon, has the character of the Laurentian formation. The most characteristic strata of this series are heavy bedded, coarsely crystalline gneisses. These are composed of quartz and feldspar, or these minerals with more or less hornblende. The feldspar often occurs in large particles, dispersed in a porphyritic manner. The hornblende is usually small in amount and poorly individualized, often being a fine dust. No mica is present, and the absence of this mineral is one of the most conspicuous features of the rock. The feldspar makes up the larger part of the material. Associated with these beds, and overlying them, come heavy bedded hornblende rocks that sometimes are composed mainly of hornblende. In these sometimes a little magnesia mica, often with a reddish color, is found These strata appear to be metamorphic diorites, since the feldspar seems to be a triclinic one. These hornblendic rocks may belong to the Huronian formation and not to the Laurentian. Overlying these strata we find a great series of beds that have the character attributed to the Huronian formation. They are the copper bearing rocks of the Blue Ridge. This forms the second series. Perhaps the most characteristic strata of this series are hydromica slates and argillaceous schists. The argillaceous schists, where the metamorphic process has apparently been carried a step farther, graduate into chlorite slate and schist. The latter is often epidotic. This material is sometimes much like an eruptive rock, and in hand specimens could not be distinguished from one. It is there without bedding or lamination, but presents a rough and massive outcrop. It, in this stage, often approaches felsite in character, and sometimes passes into true felsite. Besides these strata there are in some places, felsites that retain their bedded structure, and may be called felsite schists. This felsite schist, however, is not a distinct group of strata, but may be seen passing by insensible gradations into argillaceous or chloritic schist. It is simply the product of peculiar conditions attending the metamorphism along certain bands. The felsites of both kinds show a remarkable connection with the occurrence of copper. The copper, whether in the metallic state, or in the form of various sulphides, usually occurs in felsite. Copper often occurs in a belt of chloritic or argillaceous schist in which felsite is found only in the immediate vicinity of the ore, acting as a sort of gangue for it.

The third series of strata entering into the composition of the Blue Ridge is the thick and complex group forming formation No. I. of the brothers Rogers, and including the Potsdam sandstone with its accompanying beds. This group, embracing all the strata between the Calciferous formation and the Azoic crystalline rocks, I will call the Primordial series. It is remarkably free from fossils. I have never seen any traces of life in it except *Scolithus* casts, and these are found in the second member from the top. Other observers report the occurrence of occasional fucoidal markings. This series will be described in another connection.

Usually the central and eastern portions of the Blue Ridge are composed of the Laurentian and Huronian strata. Sometimes the lowest member of the Primordial may be found occupying the top of synclinal folds in the central portions of the chain, and in rare cases a remnant of this is found even to the east of the main mountain belt. In no case have the upper members remained in the central and eastern portions, if they at any time occupied such positions. The next to the highest member of the Primordial is an easily recognized sandstone or quartzite, which can readily be identified. This often forms the western slopes of the Blue Ridge, or produces the most westerly ridge of the mountain belt. The western ridge is often broken down into more or less detached hills, and this is especially true of the northern end of the belt which forms the subject of this description. To the south the quartzite becomes much more massive and thicker. There the most western ridge is continuous. This ridge or line of hills, throughout the belt, overlooks to the west a valley occupied by streams that flow north into the Shenandoah, or south into the James. This valley is eroded in the shales that form the highest member of the Primordial and the lowest portion of the Calciferous formation. These shales are succeeded to the west by the impure limestones and calcareous shales of the Calciferous group. Farther west come the limestones and shales of the Lower Silurian, forming Nos. II and III of the brothers Rogers, and including the strata of the Canadian and Trenton periods.

From Turk's Gap to Mount Torrey, the Blue Ridge consists generally of parallel ridges, composed of Huronian strata and the lower members of the Primordial, while the quartzite upper member forms a line of low and broken hills on the west. From Mount Torrey to the southern border of Augusta county, near the village of Midway, the quartzite member rises into a considerable plateau that thrusts out a

horse-shoe shaped expansion which has its convex side turned to the north and northwest. This forms the plateau of the Big Levels. At the southern corner of Augusta county the convex protrusion sweeps around so that the massive ribs of quartzite that form it approach closely to the main mass of the Blue Ridge, and form the most westerly ridge which is there continuous.

Most of the ores described in these notes are found in the shales that form the uppermost member of the Primordial group. These shales contain a series of deposits of iron and manganese, which, in consequence of their geological position, must be sought for just outside of, or to the west or northwest of the quartzite ridges.

The Primordial group, though a variable one, admits of division into several members which have sufficient persistence of character to enable one to recognize them even at remote points. The strata taken as a whole, in proceeding southwest, show an increasing amount of silicious matter.—This is true at least in the interval between Turk's Gap and Balcony Falls. The change is especially marked southward of Mt. Torrey. The sandstones and quartzites are thicker, more persistent, and more purely silicious. The conglomerates are more abundant and coarser. The shales are more silicious, and tend to pass into flags. Often we find, to the north of Mt. Torrey, certain of the lower members fine grained shales and nacrous slates, while to the south, at the same horizon, flaggy sandstone takes their place. This change in the physical character of the Primordial is caused by a change in the character of the Azoic rocks that were exposed on the shores of the Primordial sea, and from the ruins of which the Primordial strata were formed. To the northeast of Mt. Torrey the fine grained argillaceous strata of the Huronian form that portion of the Blue Ridge which adjoins the Primordial. Where the gneissoid strata of the Laurentian occur in this quarter, they lie some distance to the east of the junction of the Primordial with the Azoic, and have but few exposures, being buried under the Huronian.

The case is different to the southwest. There the coarse Laurention rocks, often containing a large amount of quartz, rise high in broad outcrops, and not uncommonly form the basis on which the Primordial beds rest.

The lower members of the Primordial vary more in character than the upper. Stated in the most general terms, the Primordial strata under the great quartzite member, are composed of a mass of shales, slates, and flags, with important beds of quartzite at various horizons, and with conglomerate bands in the lower portions. The conglomerates generally possess the unusual character of having the pebbles imbedded in a fine grained matrix of slate and shale, and this feature enables one to recognize them everywhere, furnishing a valuable guide in fixing the dividing line between the lowest Primordial aud the Azoic beds. The quartzites of these strata unlike the upper, or Potsdam quartzite, are quite unstable in thickness, and not uncommonly disappear, especially in the northern portion of the belt. They thicken up at the expense of the more argillaceous strata in which they are inclosed. These quartzite beds in the lowest portion of the Primordial may also be recognized by the fact that they are often colored greenish by diffused chlorite, and frequently are filled with small seams of infiltrated silica They seem to have been cracked by the disturbances to which they were subjected, and the small crevices to have been occupied by silica deposited from percolating water. The lowest of these quartzites, especially in the southern portion of the belt now in question, often have many small pebbles which are frequently pinkish in color, that were derived from the Laurentian gneisses. These features serve to distinguish the quartzites of the lower beds from the great upper, or Potsdam quartzite member. In the vicinity of Balcony Falls, as seen in the Balcony rock, the lower quartzite rivals, and even surpasses in thickness the Potsdam quartzite.

Beginning with the base of the Primordial we may recognize six divisions. The thickness of none of these could be measured accurately, owing to the great disturbances that the strata have undergone. The thicknesses given with each member are, however, approximations that do not vary much from the truth. The following are the sub-divisions, beginning with the lowest:

1.	Lower Primordial Conglomerate	0′ to 30′
2.	Lower Gray Shales and Flags	500′
3.	Red Shales and Flags	400′
4.	Upper Gray Shales and Flags	600′
5.	Potsdam Quartzite	350′
6.	Ferriferous Shales	500′

These will be described in the above order from No. 1 to No. 6.

1. *Lower Primordial Conglomerate.*—I would confine this appellation to the lowest conglomerate that forms the base of the Primordial where it is present, excluding the conglomerate bands that follow higher up, but are separated from the basal conglomerate by shale and slate. This member forms a portion of the Primal Conglomerate of the brothers Rogers, which they make 150′ thick. In this thickness is evidently included in the overlying conglomerates of the lowest Primordial. The reason for this separation will be given below.

This member, thus limited, I have not seen at all the places where the junction of the Primordial with the Azoic is exposed. It may never have been present, or, if present, may have been hidden by being engulfed in the displacements caused by the crush of the Primordial against the Azoic. It is a noteworthy fact that at the different exposures of the junction of the Primordial and Azoic, the horizon of the Primordial beds that rest on the Azoic varies. Where there is a synclinal fold, or where the dip is low, the true base of the Primordial is more often seen. But when the dip is high to the N. W., or where the strata are overturned to the N W., higher portions of the Primordial are seen in contact with the Azoic, since there has been some over-riding or faulting.

The conglomerate now in question is of special importance since, when it is found, we may be sure that we have the true base of the Primordial. I have never seen it without finding the Azoic rocks immediately under it. It consists of a finer matrix that is shaly or slaty in texture, in which particles, angular or rounded in shape, of the Azoic strata are imbedded. The lithological character of the pebbles varies with the nature of the adjoining Azoic To the south they are more commonly composed of gneissoid rock, but to the north the Huronian schists furnish the material. The amount of pebbles and matrix varies a good deal. Sometimes we find only here and there pebbles, scattered in a predominating fine grained matrix. At other times most of the mass of the conglomerate is composed of the pebbles. Some of these pebbles are quite large, reaching the size of 8 inches; uusually the large ones are only partly rounded The distinguishing features of this conglomerate, as contrasted with those immediately overlying it, are the large size of the stones, their partly rounded shape, and their composition, since they are fragments of the original Azoic rocks.

In the more southerly portions of the belt, a good deal of partly decayed feldspar may be detected in the finer matrix, but to the north, argillaceous material forms the cementing matter.

(To be continued.)

Notes on the Geology of the Virginias.

Extracts from the manuscript Note Books of the Virginia Survey of 1835-41 by Prof. William B. Rogers.

(Continued from page 12.)

Formation No. VI—the Lower Helderberg of the New York Survey, the Pre-Meridian of the First Pennsylvania Survey—is described by Prof. Rogers as follows:

"This is a limestone deposit varying in the northeast from 800 to 1200 feet in thickness. It is a much purer deposit of carbonate of lime than Formation No. II. There is very little magnesian limestone to be found in this formation, and it is generally almost free from silicious matter, except when this material occurs by itself in the form of chert, and there is not much of this except in the extreme upper part. The impurities are alumina and some carbonaceous matter. It not unfrequently occurs that the entire formation is nearly a pure carbonate of lime with the small exception of a little very aluminous slate. The strata are often massive and present a semi-crystalline texture; but there is a constant variation in this respect. At one locality we will find the formation composed almost entirely of heavy, thick beds comparatively pure; and in another, a few miles removed, we will find considerable beds of slate interrupting the continuity of the limestone and thin layers of interstratified slate between the beds of limestone; generally there is much more slate in the lower than in the upper part; and when there is much silicious matter it is in the upper part. This matter is mostly in the form of *chert*, and sometimes it exists in large quantities forming heavy beds. It is often presented in the form of nodules in heavy strata of limestone. This material is the connecting link between Nos. VI and VII. Sometimes this link consists of beds of fractured or incoherent masses of chert separated by beds of soft fissile slate.

This deposit gradually diminishes in thickness from the extreme northeast to the southwest part of the middle Apalachians where it is entirely wanting; a little chert only remains, as its equivalent, so that in the counties of Montgomery, Wythe, Giles, Russell, and Washington there is nothing of the deposit but the chert, save here and there an occasional nodule of limestone.

Beds of limestone belonging to this formation appear again southwest of the district above named. They are first seen in the southwestern part of Scott county and in the northeastern part of Lee. I think they fine out again before reaching Cumberland Gap, inasmuch as I obtained no exposure of these beds within 20 miles of that gap. But the character of No. VI is quite different there from what it is in the northeast. There heavy magnesian beds form nearly all that is presented of this formation; so much so is this the case that at a locality near to a wide hiatus, and where the exposures were not very good, I mistook the beds overlaying No. V for the very magnesian variety of No. II; but subsequently was enabled to correct the mistake. There are a few thin layers that are very little if at all magnesian and these abound in fossils.

Wherever this formation occurs fossils, numerous in amount, may generally be found. From this fact it is very appropriately called, by way of distinction, the *Fossiliferous limestone*. These are generally more abundant in the upper than in the lower portion."

Formation No. VII—the Oriskany of the New York and the Meridian of the First Pennsylvania surveys; the upper member of the Silurian general group of formations—is described as follows by Prof. Rogers:

"This formation is almost purely a deposit of coarse sand, varying in the northeast from 100 to 800 feet in thickness.

We have said this is almost purely a deposit of sand; and it is generally the cleanest of any of the arenaceous deposits which occur throughout the great secondary deposits. It is not unfrequent, in localities situated where this formation has its greatest development, to find the sand as clean and white as that used by glass manufacturers. Beds and even fragments of this formation may in most instances be recognized by their containing small, narrow, irregular cavities. Upon examination these will be found to be the molds of shells. The texture of the rock is sometimes compact and sometimes friable; the color is generally light gray and sometimes a greenish or watery gray. It is not unfrequently that we find the strata in a high degree vitreous.

The formation has its greatest development in Hardy and Hampshire counties. Its thickness is much diminished at the base of the Front Ridge of Alleghany to what it is farther southeast. This diminution is the greatest near the Potomac river. At Cumberland, Maryland, the thickness can be no more than 100 feet, while at the Little North mountain, directly southeast, it is probably more than the greatest thickness we have given to it above. It gradually diminishes as we proceed southwest and it fines out entirely in Botetourt county, nearly simultaneously with No. VI, when the chert, before referred to as connecting the two formations, continues on as the representative of both.

The character of the formation undergoes very little modification throughout its continuance. It is not often even slightly conglomeritic, save in the uppermost parts where a stratum—or it may be a few strata—is found almost purely a conglomerate, and there is a peculiarity about this in the fact that the pebbles are of nearly uniform size and oblong. In the lower part of the formation there is a gradual but quick passage from the sandstone to the chert which connects it with No. VI.

In the far southwest it reappears again with No. VI in a development of about 100 feet. The strata have a brownish tinge there and are not as cavernous. They are still fossiliferous but not as abundantly. At the upper end of Powell valley, however, in Lee county, just at the junction of VI and VII, fossils could scarcely be more numerous. It often occurs, particularly in the middle Apalachians, that a valuable deposit of *iron ore* is associated with the upper part of No. VII. Some very valuable occurrences of this kind happen also in the northeast.

Fossils are generally abundant throughout the formation, particularly in the upper part and in the lower part also.

Work of the Apalachian Division of the U. S. Geological Survey in 1882.

By Dr. W. C. Kerr.

Maj. Jed. Hotchkiss:

My Dear Sir:—Do not suppose that I had forgotten my promise to give you some items in regard to the work of the Apalachian Division of the U. S. Geological Survey, located at and operating around Bristol. I did not write sooner for several reasons: among others that I learned from Mr. Gannett that he gave you an outline of the plan of the work; and then, I found it impracticable to write in the field in the press of the work. In fact there was very little to write about, beyond stating the scheme of the work, which you already had There were four parties in the division besides my own personal party, and we were so widely separated that I never saw the other parties after they were placed in the field except to cross the path of one of them for a day or two, and to cross and work with another for a few days, just before the wind up for the season.

Only topographical work was undertaken, as this must precede the investigations of the geologists. The office of

the division was located at Bristol, Va., as being central to the richest, as well as the most undeveloped mineral region of the continent; and also central to the territory of eight or nine states, which can be reached easily from that point;—that is, all the states east of the Mississippi and south of the Ohio and Maryland. The operations of the division during the past season, although it was so late in taking the field (the middle of September),extended into four of these states; next season it will doubtless reach seven of them. The scale adopted for the maps is two miles to one inch, and the reliefs will be expressed by contour lines for every 200 feet of difference of elevation.

The past season one party was stationed on and around Roan mountain, one of the higher masses of the Smoky chain; and barometrical stations were established through a vertical range of more than four thousand feet—from about 2200 feet to 6250—and all these were connected by lines of levels, carried up from the nearest railroad branch works. The barometrical observations of the three parties engaged in the secondary triangulation and in sketching the topography in detail, are all referred to this vertical barometric base, and will be computed by the new method recently developed by Prof. S. K. Gilbert of the survey. A fifth party was engaged in executing a scheme of primary triangulation, to check the work of the other sections, and to combine their results and connect them with the system of primary triangles measured five years ago by the Coast and Geodetic Survey, in the Piedmont country east of the Blue Ridge. This primary triangulation was carried across the summits of the Blue Ridge, the Black, Yellow, Smoky and Holston ranges, to the chain of the Clinch mountain, in the middle of the great Apalachian region; and but for the early approach of winter, would have reached the Cumberland, had there been two weeks more of open weather.

The operations of the division covered a territory of nearly 3000 square miles, from the Blue Ridge in N. C., through Va. and Tenn., and beyond the Cumberland mountains. The division is now in winter quarters here in Washington, engaged in computing and mapping the season's work. No doubt we shall be able to take the field by May the present year, and with a still larger force; so that by the end of this year the work can be carried north to the Ohio and Kanawha, and south to the Coast and Geodetic Survey's chain of triangles running through Ga. and Ala, thus taking in the whole of the Southern Apalachians,—Blue Ridge, Smoky and Cumberland, and the intervening plateaus and valleys. When this belt is completed, the field will be ready for the geological survey proper, that is in 1884.

Very great interest was shown by the people of the region occupied, and important developments are anticipated from its operations. Railroad surveys are being pushed in every direction through the wildest parts of the mountains, and capitalists are investing extensively in mineral and timber lands. The narrow-guage railroad, completed last spring by a Pennsylvania iron company, from the E. Tenn., Va. & Geo. RR., at Johnson City, into the Smoky mountain at Cranberry, has not only opened up that magnificent deposit of magnetic iron ore, but a dozen others in the same section, and has brought in lumbermen with their mills, from the North, who are manufacturing cherry, walnut, ash, poplar and maple lumber faster than transportation can be found; and so those splendid forests, unequaled elsewhere on the continent, have been penetrated and are finding a market at last.

A narrow-guage railroad has been projected and partly built, westward from Bristol to the Cumberland, by another Pennsylvania company, to reach and open the great coal fields of the wild border country; and three or four other lines have been surveyed through different gaps of the mountains, between Cumberland Gap and the head-waters of Big Sandy,—by the Norfolk & Western Railroad Co., and by other organizations at Cincinnati and elsewhere on the Ohio. So that the practical development of the country will doubtless follow close on the heels of the geological survey, and this new and almost unknown region will become, in a very few years, the centre of vast mining and manufacturing industries.

U. S. Geol. Survey,
Washington, D. C., Jan. 25, 1883. W. C. Kerr.

Coal and Coke.

Midlothian, Va., Coal.—The experiments of Prof. W. R. Johnson, made from 1842 to 1844, for the U. S. Navy Department, to test the comparative value and efficiency of the coals then in use in the eastern portion of the U. S., furnish the following facts concerning the average quality of the Midlothian coal of Chesterfield county, Va.

Specific gravity	1.294
Cubic ft. of space required to stow a ton	41.45
Volatile combustible matter in 100 parts	29.86
Fixed carbon in 100 parts	53.01
Earthy matter in 100 parts	14.740
Moisture in fuel in 100 parts	2.39
Ratio of fixed to volatile combustible matter	1.78
Rate of combustion in lbs, of coal per sq. ft. of grate, per hour	6.68
Per cent of waste in ashes and clinker	14.830
Pounds of steam from water at 212°, per lb of coal	8.29
Steam from 212° from one lb. of combustible	9.741

The Cost of Coke Making at Connellsville, Pa., now the great coke making centre of this country, is, at present, as we learn from one who has recently investigated this question, about as follows:

Cost of mining 100 bushels (7,600 lbs.) of coal	$1.00
Cost of proportion of dead work per 100 bushels	.40
Cost of coking 100 bush. of coal in 3-ton ovens	.75
Total cost 3 tons (124 bush.) of coke	$2.15

As 100 bushels of coke make 124 of coke, or three tons, the above makes the actual cost of the coke—without allowing any royalty for the coal or interest on plant, profit, etc.—about 72 cents a ton. If the coke has to be stocked on the yard there is an additional cost of 8 cts. per ton, but if cars are alongside the ovens, so the coke can be loaded directly from them, this charge is avoided.

The "Am. Manufacturer" of the 16th states the price of Connellsville coke as from $1.15 to $1.40 per ton of 2,000 lbs. on board cars at ovens.—So there is still a small margin of profit in coke-making even in the present depressed condition of the iron market.

We are perfectly satisfied that coke of very considerably better quality than the Connellsville—because richer in carbon and lower in ash—can be made in the Virginias even cheaper than at Connellsville.—Some of our coke makers have already made contracts to deliver coke on the cars, for blast-furnace use, at current Connellsville rates.

A new coal bed has been opened at the Sewell mines of the Longdale Iron Co., near Sewell station of Ches. & Ohio Ry.; this bed holds a thickness of 4′ 8″ of coal, New River semi-bituminous, or coking, for the 600 ft. it has been driven in to this time.

The Duty on Bituminous Coal, on motion of Senator Davis, of W. Va., was increased from 50 cts. per ton, as reported from the committee, to 75 cts.

Great Kanawha, W. Va,, vs. Pittsburg Coals.—The *American Manufacturer*, of Pittsburg, Pa., is to be commended for its candor in its recent treatment of coal and coke trade questions. In its issue of Feb. 9th, 1883, we find the following interesting statements concerning Pittsburg coal:

"Mining has been but partially resumed since the operators reduced the price to 3½ cents a bushel; but it is the general belief that that pay will be the established rate hereafter; and as 100 bushels is but a fair day's work, the miners will be able to make $3.50 a day—or over $18 a week; which may be set down as a just compensation, when the condition of the industry is taken into consideration

It cannot be denied that the Pittsburg river coal trade is in an unpromising shape—that its prospects are anything but cheering, as appears by certain incontrovertible facts.

1. The large Cincinnati market is almost entirely monopolized by the great West Virginia region, and the Hocking Valley and other Ohio coals sent in by rail.

2. The Louisville market is being largely supplied by contiguous coals from Indiana and Kentucky, also transported by rail.

3 Operators in the Kanawha Valley are preparing to enter upon the lower river trade, and to furnish their coals to all the markets and ports from the mouth of the Kanawha to New Orleans. This extension of their trade will interfere, all along this extended line, with the established marts hitherto possessed alone by the Pittsburg operators. To this time the Kanawha operators have never made their shipments below Louisville."

In this connection we would call the attention of the Connellsville "Courier," to its misreading of the article on page 4 of our Jan. No. Our "reinforced remarks" were for the "American Manufacturer," those for the "Courier" are in hand now. The article was all about *Pittsburg coals and cokes.*—But here are the two paragraphs of the "Courier," and its "admissions" about "Pittsburg coke"—coke made from the same bed as the Connellsville, if we credit the statements of the Pennsylvania geologists of the last 45 years:

"We would have the Staunton *Virginias*, and all others interested, know that there is no Pittsburg coke made in this country. Our product is known and esteemed the world over as *Connellsville coke.* Coke made from the Pittsburg, or hard coal, we are free to admit, is much inferior to West Virginia coke. Our claim for superiority is in *Connellsville coke* alone."

"The Staunton *Virginias* claims to have a supporter in its position as to the superiority of West Virginia coke in the person of the *American Manufacturer* of Pittsburg. The latter paper is not published in the coke region and has itself much to learn about the coke trade."

New River W. Va., vs. Connellsville, Pa., Coke.—Our esteemed Connellsville cotemporary, the "Keystone Courier," has become so much alarmed for its flanks in our friendly contest over the question of the comparative merits of New River, Va., and W. Va., and Connellsville, Pa., cokes, it has called for reinforcements from the eastward, Mining Engineer Fulton, of the great Cambria works, appearing in its issue of the 9th instant, in a lengthy article, bristling with comparative figures on this subject.

We are greatly gratified that so accomplished a chemist and metallurgist as Mr. Fulton, one that we are all pleased to recognize as an authority in such matters, has entered the lists in this discussion. Aided by him we will be able to arrive at a satisfactory conclusion. We have not room for his paper in this issue, but it will appear in full, in our next, with appropriate comments.—We congatulate the "Courier" on the character of its reinforcements, but beg leave to assure it that *The Virginias* has reserves also, and is not in the least alarmed at the flourish of trumpets in its issue of the 16th.

Coal and Coke Traffic of Chesapeake & Ohio Ry. in December, 1882.—We are indebted to Gen. Manager C. W. Smith for the following returns, compiled for *The Virginias* by Fuel Agent C. M. Gibson, of the coal and coke traffic of this road, from the mines and ovens on its line, for December, 1881 and 1882, in tons of 2000 lbs.

Kind.	December traffic			
	1882.	1881.	Incr.	Decr.
Cannel	1,650	1,751	.....	101
Gas	35,699	8,262	27,437	.....
Splint and Block	8,488	21,778	.....	13,290
New River, &c.	29,026	22,836	6,190	.....
Coke	8,073	8,032	41	.....
Totals	82,936	62,659	33.668	13,391

The net increase of December 1882 over December 1881, was 20,277 tons.

Distribution of above for December.	1882.	1881.
1. To C. & O. Co. for its own use	26,101	10,920
2. To Huntington, for West via Ohio river	646	10,903
3. On Elizabethtown, Lexington and Big Sandy RR	5,246	4,495
4. On Ches. & Ohio Ry., excepting Richmond	14,819	14,364
5. To Richmond & Alleghany RR. at Clifton Forge	2,140	1,991
6. To Valley RR. of Baltimore & Ohio at Staunton	260	41
7. To Shenandoah Valley RR. at Waynesboro	2,390	491
8. To Va. Midland Ry. At Charlottesville	5,355	4,536
8. To Va. Midland Ry. At Gordonsville	.....	.....
9. To Richmond, Fredericksburg & Potomac RR. at Junction	636	971
10. To Richmond for consumption, including tugs, &c	11,870	6,079
11. To James R. wharves for shipment	3,686	7,868
12. To Newport News For consumption, including tugs, &c	277	.....
12. To Newport News For shipment	9,510	.....
Totals	82,936	62,659

The above should have appeared in our last issue, but it came to hand too late for that purpose; to keep our record complete it is published now.

The Coal Traffic of Ches. & Ohio Ry. during 1883 and 1882. as reported for *The Virginias* by Fuel Agent C. M. Gibson, by kinds of fuel moved, was as follows, in tons of 2000 lbs:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	1,672	1,459	213	.....
Gas	24,616	13,862	10,754	.....
Splint and block	13,655	16,398	.....	2,743
New River, &c	31,23	26,002	5,235	.....
Coke	9,448	9,266	182	.....
Total	80,628	66,987	13,641	.....

	1883.	1882.
1. To C. & O. Co. for its own use	19,264	13,095
2. To Huntington, for West via Ohio river	176	9,055
3. On Elizabethtown, Lexington & Big Sandy RR.	4,209	6,758
4. On Ches. & Ohio Ry. Ry. excepting Richmond	16,527	12,632
5. To Richmond & Alleghany RR. at Clifton Forge	1,392	1,286
6. To Valley RR. of Baltimore & Ohio at Staunton	63	44
7. To Shenandoah Valley RR. at Waynesboro	139	1,216
8. To. Va. Midland Ry. At Charlottesville	5,096	4,153
8. To. Va. Midland Ry. At Gordonsville	.....	17
9. To Richm'd, Fredericksb'g & Potomac RR, at Junc	419	1,073
10. To Richmond for consumption, including tugs, &c	13,107	8,010
11. To James R. wharves for shipment	2,494	9,648
12. To Newport News For consumption including tugs, &c.	830	.....
12. To Newport News For shipment	16,912	.....
Totals	80,628	66,987

The Coal Traffic of Ches. & Ohio Ry. during 1882 and 1881, as reported for *The Virginias* by Fuel Agent C. M. Gibson, by kinds of fuel moved, was as follows, in tons of 2000 lbs:

Kind.	1882.	1881.	Increase.
Cannel	30,910	25,183	5,727
Gas	345,905	229,564	116,341
Splint and block	124,422	177,786	.....
New River, etc	357,744	263,517	94,227
Coke	91,919	77,376	14,543
Totals	950,900	773,426	230,838

There was a decrease of 53,364 tons in 1882, in the movement of splint and block coals, those of the Kanawha region proper, where there are improved facilities for river transportation; this reduced the net increase of 1882 over 1881 to 177,474 tons, a gain of very nearly 23 per cent.—The gain in cannel was over 22 per cent, in gas coal nearly 57 per cent, in New River coal over 36, and in coke about 19 per cent.

The fuel moved in 1882 and in 1881 was distributed and delivered as follows:

	1882	1881.
1. To C. & O. Co. for its own use	189,617	128,408
2. To Huntington, for West via Ohio river	49,535	111,476
3. On Elizabethtown, Lexington & Big Sandy RR.	54,619	36,705
4. On Ches. & Ohio Ry. Ry. excepting Richmond	127,261	131,787
5. To Richmond & Alleghany RR. at Clifton Forge	14,557	7,067
6. To Valley RR. of Baltimore & Ohio at Staunton	719	437
7. To Shenandoah Valley RR. at Waynesboro	20,729	3,827
8. To. Va. Midland Ry. { At Charlottesville	55,421	52,800
{ At Gordonsville	87	540
9. To Richm'd, Fredericksb'g & Potomac RR, at Junc	7,624	10,645
10. To Richmond for consumption, including tugs, &c	116,536	79,501
11. To James R. wharves for shipment	188,083	210,233
12. To Newport News { For consumption including tugs, &c.	8,020	.....
{ For shipment	118,242	.....
Totals	950,900	773,426

The suggestive comparative features of the distribution of the coal mined and the coke made on the C. & O. and shipped by it in 1882 and 1881, are—(1) The increased consumption of fuel by this company in 1882, and the large increase in deliveries to Elizabethtown. Lexington & Big Sandy, to Richmond & Alleghany, to Valley Div. of Baltimore & Ohio, to Shenandoah Valley and to Virginia Midland railways,—indicating the largely increased business of these railways in 1882:—(2.) The diminution of shipments to Huntington, W. Va., for Ohio river trade by water, and to Richmond, Va., for shipment by James river (results of the extension of the C. & O., westward and eastward from these points), and the slight decrease in deliveries along C. & O., (a result of the blowing out of one of the large blast-furnaces, on its line, for repairs:—(3.) The handsome increase for consumption at Richmond, showing the increased business activity of that thriving manufacturing and commercial city: (4.) The delivery of 118,242 tons of coal—very nearly one-eighth of all moved by this railway in 1882—at Newport-News, for shipment, during the first year of the opening of the extension of the C. & O. to that point for business,—a slight foreshadowing of the enormous traffic in coal that in the near future is to make that *the coaling station* of our Atlantic seaboard.

The Use of Coke for Locomotives on American railways is now attracting considerable attention. A recent run of 82 miles, with a train of 131 loaded coal cars and 2 cabin cars, was made on the Reading road, with coke as a fuel. The run was made in 6 hours, 32 minutes, and 9,800 lbs. of coke were used, including the firing up. Each pound of fuel used, evaporated 7.09 lbs of water. The fire box used was larger than the ordinary ones. The "Railroad Gazette" gives the particulars of this experiment and considers it a successful one.

The Collieries and Coke Works on Baltimore & Ohio Railroad and Branches.

Vice-President Robert Garrett of the Baltimore & Ohio Railroad has, in compliance with a request, provided *The Virginias* the following complete lists—the first that have been published, so far as we know—of the collieries and coke works on the main lines and branches of that great railway, and the distance of each from Baltimore and its daily capacity, January 1, 1883. Our readers will be greatly obliged for this valuable information.

1.—Collieries in West Virginia on Main Lines.

Name of Colliery.	Miles from Balto.	Name of Company or Operators.	Daily Capacity, in Tons.
Austin	263¼	Austin Coal Co.	100 to 150
Newburg-Orrel	267	Newburg-Orrell Coal Co.	300 " 400
Montauk	289¼	Montauk Coal Co.	400 " 550
Tyrconnel	291¾	Newburg-Orrell Coal Co.	300 " 400
Ocean	299	Consolidated Coal Co.	150 " 300
Smith	300	Murphy Run Coal Co.	130 " —
Despard	300½	Despard Coal Co.	130 " 200
Harrison County	301¼	Harrison Co. Coal Co.	100 " —
Pinnie Kinnick	301¾	Jackson & Clifford	150 " 300
Farlands	303¾	Farland	— " —
Monongahela Gas	385¼	Monongahela Gas Coal Co.	250 " 300
Wolf Summit	309¾	W. Nolan.	20 " —
Palatine	300¼	Newburg-Orrell Coal Co.	200 " 300
Gaston	300½	Gaston Coal Co.	300 " 500
American	301	Not working at present.	200 " 300
New York	301¼	" " " "	200 " 300
Watson	301½	" " " "	200 " 300
Central	303	O. Jackson, Supt.	250 " 300
West Fairmont	303¼	West Fairmont Coal Co.	80 " 100
Empire	208¾	Black, Sheridan & Wilson.	150 " 200
Elm Grove	384	Elm Grove Coal Co.	75 " 150
Boggs Run	376¾	Boggs Run Coal Co.	40 " 50
" "	375¾	" " " "	20 " 30
Bell	379	W. Bell.	10 " 20
Brooks	"	Kasley Brooks.	40 " 50
Glass-house	"	Glass-house Works.	10 " 20
Kimberly	"	P. L. Kimberly.	40 " 50
Warner	"	G. Warner.	20 " 30
Marshall	"	W. Marshall.	40 " 50

2. Collieries on Pittsburg Division.
(Gas Coal Mines.)

Name of Collieries.	Miles from Balto.	Name of Company or Operators.	Daily Capacity, in Tons.
Osceola	308	Osceola Coal Co.	325
Alpsville	307	B. F. Rufferty & Co.	400
Youghiogheny & Ashtabula		Y. & A. Coal Co.	350
Shaner	303½	B. F. Rufferty & Co.	800
Armstrong	302	" " "	200
Ocean		W. L. Scott & Co.	850
Annieville	298	N. J. Bigby	600
Penn. Gas No. 4		Penn. Gas Coal Co.	500
Yough Slope	296⅛	B. F. Rufferty & Co.	400
West Newton	296	Osborn Coal Co.	400
Markle	295	C. P. Markle & Son.	100
Port Royal	291	Port Royal Coal Co.	350
Smithton	289½	B. F. Rufferty & Co. [& Co.	740
Eureka	288½	Fox, Kefer & Co or (B.F.R.	450

(Semi-Bituminous Coal Mines, near Myersdale.)

Keystone	213	Keystone Coal Co.
Baltimore-Cumberland	214	Balto. & Cumb Coal Co
Cassellman	219½	Cas ellman Coal Co
Swede	215	Swede Iron & Coal Co

(Semi-Bituminous Coal Mines on Berlin Branch.)

Name of Collieries.	Miles from Balto.	Name of Company or Operators.	Daily Capacity, in Tons.
Price	262	Thos. Price & Co.	
Maher	"	R. Maher & Co.	
Adams	"	Thos Adams,	
Buffalo Valley	"	Buffalo Valley Coal Co.	
Morgan	"	Morgan & Co.	

(Semi-Bituminous Coal Mines on Salisbury Branch.)

Elk Lick	220	Cumberl'd & Elk Lick C.Co.	
Cumberland	"	Cumberland Coal Co.	
Meyersdale	"	Meyersdale Coal Co.	
Salisbury-Central	"	Salisbury Central Coal Co.	
Fair-View	"	Fair-View Coal Co.	
Salisbury	"	Salisbury Coal Co.	
Cochran	"	Jas. Cochran.	
Smith	"	W. J. Smith & Co.	
Grassy Run	"	Grassy Run Coal Co.	
Hocking	"	Hocking Coal Co.	

Semi-Bituminous Coal Mines on Cambria & Somerset Branch.

Hooversville	253½	Hooversville Coal Co.	

Coke-Works on Pittsburg Division.

Name of Coke-Works.	Miles from Pittsburg	Name of Operators or Company.	Number of Ovens.	Daily Product, in Tons.
Alpsville	21⅓	B. F. Rufferty & Co.	29	45
Scott Haven	27½	W. L. Scott & Co.	25	30
Smithton	38¾	B. F. Rufferty & Co.	117	180
Eureka	39¾	Fox, Kefer & Co.	10	15
Fayette	60	Cochran & Co	101	120
Jackson	53¾	" "	65	90
Washington	55	" "	35	50
Tyrone	54¾	Laughlin & Co	116	180
Sterling	54¼	J. M. Schoonmaker.	159	240
Jimtown	54	"	320	480
Cora	55	J. S. Newmyer	35	50
Pittsb'g & Consv'lle. Gas Coal & Coke Co	55	J. F. Dravo	253	375
Novelty	"	H. C. Frick Coke Co	100	150
Henry Clay	"	" " "	106	160
Morgan	56	" " "	164	240
Globe	56	" " "	175	270
Foundry	"	" " "	74	120
Eagle	"	" " "	152	225
Valley	57	" " "	80	120
Summit	57	" " "	142	210
Tip Top	58	" " "	56	80
Franklin	60	Cochran & Keister.	50	75
Clinton	"	J. S Cochran, & Co.	50	75
Fountain	"	W. H. Blake & Co.	50	75
Dexter	"	J. R. Stauffer	40	60
Painter	61	McClure & Co.	208	315
Diamond	61⅓	"	60	90
Mullins	64	"	262	400
Buckeye	63	J. M. Schoonmaker.	116	180
Stauffer	63½	B. F. Coughmann.	20	30
Standard	65	A. A. Hutchinson & Bro	600	1050
Watt	61	Reid Bros.	70	105
Mahoning	62	Brown B & Co.	100	150
Anchor	61½	Henderson Bros.	100	150
Dunbar	61¼	J. S. Colvin & Co.	100	150
Lemont	66½	Lemont Furnace.	121	180
Mt. Braddock	64	A. O. Trustman.	117	180
Evans	68	Stewart Iron Co.	80	120
Dickson Run	60	W. J. Rainey.	50	75
Morrell	62	Cambria Iron Co.	500	800

Coke-Works on Main Lines, in West Virginia.

Name of Coke-Works.	Miles from Wheeling W Va.	Name of Company or Operators.	Number of Ovens.	Daily Product; in Tons.
Austin	115	M. L. Shaffer.	50	65
Newburg	112	C. Mackall, Sec'y.	33	50
Tyrconnel	111¼	" " "	25	40
Monongahela	75	Monongahela Gas Coal Co	30	40
Central	76	O. Jackson.	10	15
West Fairmont	75	West Fairmont Coal Co.	18	27
West Fairmont Shaft	75	" " " "	12	18
Farlands	76	Farland.	20	30

U. S Army Test of Kanawha Splint Coal.—We are indebted to Gen. M. C. Meigs for a copy of "The record of experimental tests of various fuels designed for the use of the United States Army, made from 1879 to 1882 in the office of the Quartermaster General at Washington, D. C" Gen. Meigs, now retired, was Q. M. Gen. when these tests were made by Mr. L. M. Zunker, a mechanical engineer of the Polytechnic School, Carlsruhe, Germany. These tests were made to determine both the "relative" and the "actual value," as fuel, of the various kinds of fuel purchased and issued for the use of the Army, as a matter of interest and justice to the officers and to the enlisted men, and to furnish information to guide the department in its decisions concerning fuel questions. This report fills 85 closely printed pages, giving the full details of 106 experiments—75 made with the Little Giant boiler, 25 of them with Pa. anthracite and 50 with different semi-bituminous, bituminous, lignite, and cannel coals; and 31 with the new vertical water-tube boiler, 6 of them with Pa. anthracite and 25 with other coals, same as with the other boiler. The coals used for these tests were from all the coal producing portions of the United States, from Great Britain, from Australia, and from Vancouver island; hence the range of comparison was wide and the standard of excellence correspondingly high.

We have room for but few of the data and conclusions of this very valuable report, one that will be a standard for reference; but the following have a special value:

"*There is but one measure of the relative value of coals*; it is to be found in the number of pounds of water at 212° Fahr. which one pound of that coal will evaporate into steam in a good steam boiler."

"*The qualities required of any material which we desire to use as a fuel* in industrial pursuits, and also for domestic use, may be classed in the following three points: (1) Material must be capable of burning in open air, and once ignited, combustion must continue of itself. (2) The air must not be contaminated or rendered unfit for use by the gases developed by its combustion. (3) It must not be too expensive."

"*Bituminous coal* varies greatly in heating power; there are, in fact, twenty-five kinds, mined in different sections of the country, now in use for military purposes, of which the heating powers vary, and which cannot be classified under one heading"

The only West Virginia coal used in these experimental tests was splint coal from the Crown Hill mine, in the Coalburg bed, at Paint Creek, Kanawha county, W. Va., of which Mr. Brewer Smith is Superintendent. Mr. Smith sent the coal for this trial to Capt. A. F. Rockwell, A. Q. M., Wash-

ington, D. C.—The report is in error in stating that it was from "Brown" Smith.

This Crown Hill splint coal was tested with the Little Gian boiler at four different times in April, 1880, as detailed on page 35 of the report. The result of these trials, as recorded on page 60, gave this coal the following record :

Number of pounds of water evaporated per pound of coal from atmospheric pressure and 212° Fahrenheit	7.02
Equivalent evaporation from atmospheric pressure and 212° Fahr. divided by coefficient 0.843 (for equivalent for comparison with Prof. Johnson's report).....	8.34
Equivalent in pounds of coal per one cord of standard oak..	1,800

In these trials 49 different kinds of semi-bituminous and bituminous coals were used, from all portions of the U. S., from Eng., and elsewhere, and among all these the Crown Hill coal ranked 4th in the order of evaporative power, being only surpassed by two semi-bituminous coals, one from Somerset county, Pa., and the other from George creek, Md., and by a coal from Colorado. The Monongahela, Pittsburg, and Allegheny, Pa., coals ranked 6th, 7th, 8th, and 17th in comparative merit, and the Tenn. coals 15th and 16th.

The Crown Hill splint coal was also tested at four different times in October, 1881, with the New Vertical Water-tube boiler designed by Gen. Meigs, as detailed on page 70 of this report, along with 30 other coals—anthracite, semi-bituminous, bituminous, lignite, etc.—from all parts of the United States, from England, Scotland, and elsewhere. In the comparative statement of the results of these experiments, given on pages 81–83 of this report, the following is the record of the Crown Hill splint :

Duration of experiment (in hours and minutes).....		16:55
Number of pounds of coal supplied to grate.....		600
Number of pounds of coal withdrawn and separated after trial		13
Number of pounds of coal actually consumed.....		587
Number of pounds of refuse from the coal in—	Ashes.....	39.0
	Clinkers	7.5
	Total pounds of refuse,	46.5
Number of pounds of combustible used.....		540.5
Percentage of combustible in coal.....		91.90
Pounds of coal consumed per hour.....		34.77
Pounds of coal consumed per hour per square foot of grate surface.....		10.70
Total pounds of water supplied to boiler.....		4,288.82
Number of pounds of water evaporated per hour		253.93
Number of pounds of water evaporated per hour per square foot of grate surface.....		78.13
Number of pounds of water evaporated per pound of coal....		7.30
Number of pounds of water evaporated per pound of coal from atmospheric pressure and 212°.....		8.34
Equivalent in pounds of coal per one pound of standard oak		1,796

In this series of experiments, in all the elements that were considered, the Crown Hill splint ranked 12th,—being preceded by two semi-bituminous coals from Somerset county, Pa., five Pa. and one N. M. anthracites, and one N. M. and two Pa. (a Pittsburg and a Monongahela) bituminous coals. Excluding the anthracites it would rank 6th. Excluding the anthracites and semi-bituminous coals it would rank 4th, or same as in the former trials.

Taking Gen. Meigs' "but one measure of the relative value of coals," "the number of pounds of water at 212° Fahr., which one pound of that coal will evaporate into steam in a good steam boiler," as the only rule for excellence, the Crown Hill splint ranks 7th in the experiments with the Meigs boiler—or but one place lower than in the experiments with the Little Giant boiler—being only preceded by two semi-bituminous coals from Somerset county, Pa., a Lykens Valley, Pa , anthracite, two Pa. (a Monongahela and a near Pittsburg) and a New Mexico bituminous.

It is worthy of note that the percentage of combustible matter in the Crown Hill splint was greater than that in any of the coals that had precedence of rank over it in the experiments with the Meigs' boiler, except a bituminous one from near Pittsburg.

As this Crown Hill splint *leads all the bituminous coals tested* with the Little Giant boiler, by handsome per cents, including all those that in the trials with the Meigs' boiler took precedence of it, it follows that the Meigs' boiler was not adapted to its use—although its rank was high even in that—and that with a boiler of suitable construction it is a steam coal of rare excellence.

Since writing the above we have learned from an authority in such matters in that region, that Alice furnace, at Ironton, Ohio, is using Crown Hill splint coal, raw, with very great satisfaction, in the manufacture of pig iron and that the Burgess Steel and Iron-works at Portsmouth, Ohio, consider it the best, purest, and most economical fuel it has ever used in its operations.

The bed of coal from which the Crown Hill splint is mined is one of the thick and uniform seams that, above water level, underlies a large area in the Great Kanawha coal field ; so it is very gratifying to be able to record such results as the above from its use.

The Crescent Coal Mines, at Cresent station and post-office, Fayette county, W. Va., on line of Chesapeake & Ohio Ry., 78 miles east of Huntington, of which Capt. W. R. Johnson is proprietor and Mr. Thos. A. Bartlam, superintendent—now consist of three mines, fronting on the C. & O. Ry., and Great Kanawha river and one on Morris creek, the latter, sub-leased to Carver Bros., is connected with C. & O. by a branch road.

The shipments of coal from these 4 mines in 1882, were about 10,000 tons as against 85,000 in 1881. Their present capacity is fully 1000 tons a day, but transportation cannot be procured for half that quantity. Since June, 1882, a tipple has been completed at the river, from which three barges can be loaded at one time, and the "Eagle" coal bed opened, at a cost of $15,000.

These mines furnish the superior gas and steam splint coals that are peculiar to the Great Kanawha field, and during the six years they have been in operation they have acquired a deservedly high reputation in both Western and Eastern markets.—The "Crescent" or "Coal Valley" bed here worked ranges in thickness from 5½ to 6½ feet.

Hon. John E. Kenna, the recently elected U. S. Senator from West Virginia, is a most worthy successor to Senator H. G. Davis, for like him he has worked his way upward from among the toilers of the fields and forests, camps and mines, to the high position he now occupies. It is a good thing for West Virginia and a good thing for the whole of the Union to have such men for law and treaty makers ; they understand the real wants of the country in this its development era, and have the hardihood and conviction, born of experience in straitened and varied circumstance, to aid them in working for and securing wise laws.—We wish we had the space to republish the story of Senator Kenna's life recently published in the Wheeling "Register"; it is one full of encouragement to every young man possessed of will power but wanting in money power.

The Geolgist of N. C., Dec. 18, 1882, says : "Unfortunately for us we have no journal like "The Virginias." Every number of it makes me envious. As we have no such journal nor can get one, the only thing to be done is for the state to take hold of the matter of making known our resources."

Woody Matters.

Lumber Traffic of Ches. & Ohio Ry. in 1882.—We are indebted to Gen. Manager C. W. Smith for the following summary of the quantity of lumber, in 2000 lbs. tons, received at each of the stations named during the year 1882:

Newport News	12,379	Charlottesville	9,138
James River	35,090	Staunton	3,013
Richmond	13,546	Huntington	15,546
Gordonsville	126	Other stations	27,949
Total tons of lumber moved			116,786

This shows that most of the movement was to the Atlantic seaboard,-lumber mainly from W. Va. for exportation.

The following table shows the tons of lumber moved during each month of 1882. It is interesting and suggestive, indicating the *lumbering months* of the Virginias.

January	5,243	July	9,258
February	4,520	August	10,533
March	7,823	September	9,075
April	11,426	October	16,761
May	13,512	November	10,352
June	8,551	December	9,732

We regret that the kinds and sources whence derived of this lumber are not given.

Amount of Tannin in Bark of same Virginia Trees.—Forestry bulletin No. 24 of the 1880 Census, dated January 15, 1883, is devoted to showing the Amount of Tannin in the bark of some of the trees of the U. S. We have selected from this table the trees named in it that are found in the Virginias, and give the list below with the percentages of tannin and of ash found in the rossed bark—bark that has had its rough outside coating scraped or shaved off—of each.

This table was prepared by Mr. S P. Sharples, who, as special agent, has charge of the chemical and physical work of the Forestry division of the census. His method of determining the tannin is stated in this bulletin.

Common Name.	Botanical Name.	Percentages of Tannin.	Ash
White oak	Quercus alba	5.99	6.11
Bur oak	macrocarpa	4.59	8.05
Swamp chestnut oak	Prinus	6.23	3.83
Yellow chestnut oak	Muhlenbergii, old	4 33	8.38
	Muhlenbergii, young	10.33	6.23
Red oak	rubra	4.56	4.43
Black or quercitron, do	tinctoria	5.90	5.73
Spanish	falcata	8.50	4.32
Black-jack	nigra	4.36	6.28
Chestnut	Castanea vulgaris	6.25	2.00
Black spruce	Picea nigra	7.20	2.84
Hemlock	Tsuga Canadensis	13.11	1.31

Prof. C. S. Sargent, who has charge of the Forestry division of the census, comments on the above determinations, that they give the proportion of tannin found in each kind of bark but do not indicate its real value for tanning purposes, since that can only be determined "by actual experiments on a large scale, other properties in the bark, beside the percentage of tannin, affecting the value of the leather prepared with it." They are approximations that may serve to indicate species of trees that may be looked to as possible sources of tannin supply.—It is to be hoped that the final report on this subject will furnish us some of the "other properties" of our tan-bark trees.

The Mineral and Metal Traffic of Chesapeake & Ohio Ry. in 1882, in tons of 2,000 lbs., furnished *The Virginias* by General Manager C. W. Smith, giving the origin and destination, in kind and quantity, of each, were as follows:

Iron Ore.

Origin.	*Destination.*	*Tons.*
Clifton Forge	Low Moor	845
	Quinnimont	11,359
	Huntington	14,923
Buffalo Gap	Quinnimont	190
Jackson River	Low Moor	334
	Quinnimont	122
Covington	Huntington	104
	Quinnimont	1,732
Backbone	Low Moor	1,856
	Quinnimont	8,201
	Huntington	4,707
Kanawha Falls	Quinnimont	1,262
Stone Cliff	Huntington	247
Low Moor	Huntington	49
	Covington	22
Alleghany	Huntington	12
Copeland	Low Moor	306
Millboro	Staunton	100
Total movement		46,370

Pig Iron.

Origin.	*Destination.*	*Tons.*
Richmond	Low Moor	22
Ferrol	Huntington	296
	Richmond	18
Longdale	Richmond	2,107
	R. F. & P. Junction	56
	Staunton	14
	Clifton Forge	157
	Newport News	16
	Huntington	21,140
Jackson River	Huntington	1,761
	James River	445
Low Moor	Richmond	3,833
	R. F. & P. Junction	404
	Staunton	973
	Goshen	65
	Huntington	13,612
	Newport News	13
	James River	2,528
	Charlottesville	60
	Jackson River	537
	Ronceverte	5
	Charleston	1,797
Staunton	Goshen	80
	Richmond	190
Quinnimont	Huntington	11,222
	James River	904
	Richmond	1,067
	R F. & P. Junction	54
Fire Creek,	Huntington	21
Huntington	Goshen	10
	Barboursville	12
	Richmond	23
James River	Huntington	409
Charlottesville	Waynesboro	63
Clifton Forge	Huntington	669
	Richmond	148
	Charleston	15
	Quinnimont	757
Total movement		65,500

Limestone.

Origin.	Destination.	Tons.
Fort Spring	Quinnimont	15,053
Bell Valley	Goshen	4,438
Total movement		19,490

Lime.

Origin.	Destination.	Tons.
Richmond	Local Points	300
Waynesboro	" "	780
Fishersville	" "	556
Staunton	" "	300
Fort Spring	" "	325
Afton	" "	180
Alderson	" "	17
Total movement		2,458

Manganese.

Origin.	Destination.	Tons.
Huntington	Charlottesville	24
	James River	13
Waynesboro	Huntington	20
	James River	78
	Newport News	393
Tolersville	James River	55
	Richmond	124
Charleston	James River	48
	Staunton	12
	Huntington	41
Total movement		807

Slate.

Origin.	Destination.	Tons.
Clifton Forge	Huntington	795

Marble.

Origin.	Destination.	Tons.
Goshen	Charlottesville	18
	Waynesboro	13
Craigsville	Staunton	181
	Waynesboro	2
	Huntington	28
	James River	70
	Charlottesville	274
Total movement		675

Salt.

Origin.	Destination.	Tons.
Newport News	Local points	168
Richmond	" "	1,202
Malden	" "	880
Charleston	" "	1,036
James River	" "	890
Total movement		4,176

The Lynchburgh Iron Co's Furnace, at Lynchburg, Va., having been put in thorough repair, went into blast the early part of this month in charge of Mr. Stephenson. Its output will be about 25 tons a day. It is reported that this Company will buy the iron mines of Gen. Munford, near Blue Ridge station of Norfolk & Western RR., the ones from which it now obtains its ores.

The Forests of West Virginia.—Forestry Bulletin No. 25 of the U. S. Census of 1880, by Special Agent C. S. Sargent, under date of March 1, 1883, has just come to hand. It is devoted to the Forests of West Virginia and is illustrated by a handsomely executed small scale county map of that state, "Showing the distribution of its forests with special reference to the lumber industry." This map shows, in colors: (1) the region from which the valuable timber has been largely removed; (2) The region of forests chiefly of hardwood; (3) The spruce (*Picea nigra*) belt; and (4) The white pine (*Pinus strobus* belt.

We are not prepared to accept as correct the conclusions presented on the map as to the extent of the areas "from which the valuable timber has been largely removed,"—especially those in the great Kanawha and Guyandot basins. They are made much too extensive.—We hope to be able to reproduce this map, that we may comment on it intelligently. It makes a capital exhibit for West Virginia as a timber producing state.

The following is the full text of this bulletin:

The forests of West Virginia, with the exception of the belts of pine and spruce confined to the higher ridges of the Alleghany mountains, are principally composed of broad leaved trees, the most important of which are the White and Chestnut Oaks (*Quercus alba* and *Q. Prinus*), the Black Walnut (*Juglans nigra*), the Yellow Poplar (*Liriodendron tulipifira*), and the Cherry (*Prunus serotina.*)

The forests have been largely removed from the counties bordering the Ohio river, and the most valuable timber along the principal streams, especially the Black Walnut, Cherry, and Yellow Poplar, has been culled in nearly every part of the state.

The Black Walnut, found scattered everywhere in West Virginia, is least plentiful in the northwestern and Ohio river counties and most abundant along the upper waters of the rivers flowing into the Ohio through the southwestern part of the state.

Yellow Poplar is found throughout the state, and is still abundant about the headwaters of nearly all the principal streams.

Large bodies of Cherry are found in Greenbrier, Nicholas, Webster, and other counties immediately west of the mountains.

A large amount of Hemlock (*Tsuga Canadensis*) is scattered throughout the valleys and ravines of the northeastern part of the state and along the western slopes of the Alleghanies.

The area still occupied by White Pine (*Pinus strobus*) is estimated to extend over 310 square miles, and to contain about 990,000,000 feet of merchantable lumber.

The principal centres of lumber manufacture are along the Kanawha river, at Ronceverte, Greenbrier county, at Parkersburg, and along the upper Potomac.

The lumber product of the state for the census year was 180,112,000 feet of lumber, 12,071,000 laths, 3,695,000 shingles, 41,992,000 staves, and 1,952,000 sets of headings, valued at $2,431,857.

Douthat Iron Lands.—The trustees of the great "Douthat survey," about 100,000 acres, in Alleghany, Bath and Highland counties, Va., have recently leased a portion of the large deposit of iron ore on the waters of Pounding-mill run, adjoining and forming part of the beds that were mined for the old Dolly Ann furnace, on a royalty of 25 cents per ton. The lessees are now constructing a branch railway down the run to the Chesapeake & Ohio Ry. near the bridge over Jackson river some three miles east of Covington. They will soon be able to supply large quantities of excellent ore, intending to be miners and shippers, at least for the present.

The West Virginia Central & Pittsburg Ry. Co. has favored us wtth a copy of the report of its president, Senator H. G. Davis, to its board of directors, of Oct. 17, 1882. From that we gather the following interesting items concerning this important West Virginia railway, one that is rapidly becoming a prominent factor in the development of that rising commonwealth.

On the 19th day of October, 1881, the railroad of the Company was completed from the junction with the Baltimore and Ohio Railroad to the Elk Garden Mines, a distance of 12½ miles, and opened for traffic; and on the 20th, the day following, the Company began the shipment of coal from the Elk Garden Mines, and has continued to do so regularly since.

In July last the "Big Vein Coal Company," owning coal lands on the line of the road about 9 miles from the junction, opened its mines and began shipping coal from Windom Station, and has continued to do so since, their average shipments being now above 200 tons daily. Another company is now prepariug to open their mines and ship coal. There are also several saw-mills on the line of the road, and others in process of erection.

From October 20, 1881, to J nuary 1, 1882, the Company produced and sent to market, tons (of 2,240 lbs.)	11,372
From January 1 to October 1, 1882	172,471
Shipped as follows:	*Tons.*
East by the Baltimore & Ohio RR.	121,100.09
" " " Chesapeake & Ohio Canal	9,570.17
West " " Baltimore & Ohio RR.	32,696.04
Baltimore & Ohio RR. use, and local	20,471.07
Total—all taken from one opening	183.837.37

The average net profit on the production of 172,471 tons of coal for nine months—from January 1 to October 1—after allowing 20 cents per ton freight to the Company, was 45 7-100 cents per ton.

Earnings from Transportation.

The gross earnings on 12½ miles of road for the nine months from January 1 to October 1, 1882—were	$42,205.21
The operating expenses were	17,372.86
or 41 16-100 per cent of the gross earnings.	
Net profits from transportation	$24,832.35
Profits from sale of coal for same period	77,732.74
Total net profits of the Company from January 1, to October 1, 1882	$102,565.09

which have been expended in making improvements and in construction of the road from Shaw to the Upper Potomac Coal Fields.

Although for nine months 41 16-100 per cent of the gross earnings for operating expenses is moderate, yet since the road has been thoroughly completed this has been considerably reduced

For the months of August and September, 1882, the average net earnings from transportation alone were more than $5,000 per month, a rate not only more than enough to pay the interest on the $617,000 of bonds outstanding October 1, 1882, but more than enough to pay the interest on the $1,000,000 of bonds, amount authorized to be issued and sold to complete the road to the Upper Potomac Coal Fields—about fifty miles; and that the average operating expenses were 23¾ per cent of the gross earnings. The net earnings of the road have always been equal to or more than the interest on the bonded indebtedness.

The average net profit of 45 7-100 cents on a ton of coal from January 1st to October 1st, 1882, besides the 20 cents per ton allowed the Company for freight, which would make the net profit from sale of coal 56 25-100 cents per ton, is large, and is due to the high prices obtained for coal during the suspension of mining in the Cumberland region from March until August, owing to the strike of the miners, the coal companies refusing to pay but 50 cents per ton for mining coal, while the miners demand 65 cents. This rate of profit cannot be maintained in the future. Notwithstanding the strike was general in the Cumberland region, and lasted five months, yet the Company was fortunate enough to continue mining coal—not losing a day—at 50 cents per ton. This good result was due to the fact that parties now largely interested in the Company, in 1880, anticipating the opening of the Elk Garden Mines by the Company, reduced the price of mining in the mines they owned south of the Baltimore and Ohio Railroad to 55 cents a ton, and this has remained the price since, notwithstanding the strike.

By an arrangement with the Baltimore and Ohio Railroad Company, the Company has jointly built and secured the exclusive use of a track from the junction into Piedmont, about one mile. This gives the Company connection at Piedmont with Baltimore and Ohio trains, and greatly facilitates it in securing coal cars and generally transacting its business.

The Company is now engaged in making its second opening on the Big Vein near Elk Garden, which will be completed and ready for the shipment of coal in about sixty days. This will enable the Company to nearly double its capacity for the production of coal from the Big Vein.

The road from the junction to the Elk Garden Mines has been constantly improved since it was opened, and is now in first-class condition. It has been in operation about one year, and, although heavy consolidation engines are used and long trains moved daily, yet in operating the road there has not been a single accident, and only an occasional delay of a few hours.

According to the report of the Superintendent of the Mines, there are now employed in the Mining Department some 300 men, of whom 250 are miners and the rest laborers of various kinds.

He closes his report by saying: "The mine is in thorough working condition, and the entire mining plant, from dump house to the end of the mine, is first-class in every particular"

Grading and track laying on the extension from Shaw to the Upper Potomac Coal Fields near Fairfax Stone, a distance of 36 miles, has been somewhat delayed, owing to the wet season and slips on the sides of the mountains.

From the report of the engineer in charge of construction, there had been completed, on the 1st day of October, on the extension, 6½ miles of track and 17 miles of grading, leaving 12½ miles to be graded, 7 miles of which, he estimates, can be finished from the 1st to the 15th of December next, and the remaining 5½ miles by the 1st of February, 1883. There is now (October 17) 9 miles of track completed from Shaw, making 20 miles of track from Piedmont, and in all 22½ miles of completed road. The Engineer reports that on October 1 there were 810 men engaged in grading and masonry on the extension, besides the force laying track, which numbers about 50 men.

He further reports that there will be no tunnels on the line; only two trestles—one near the junction, 200 feet long, and one 3½ miles east of the summit, 150 feet long; and two bridges across the north branch of the Potomac—the first, 26 miles from the junction, will consist of two iron trusses, 100 feet each, now finished and ready for transportation; one abutment and the pier, both on solid rock, are finished, and

the other abutment will be completed by November 1. The second bridge will recross the Potomac into West Virginia near the mouth of Buffalo Creek, eight miles from the first; it will have an 100 feet iron truss. Both bridges are built by a leading manufacturer, are of unusual strength, and adapt- to the heaviest rolling stock He estimates that the grading and masonry on the extension ought to be completed by February, 1883, and the whole line opened for business early next spring.

The line of the road enters the State of Maryland at a point about 27 miles from Piedmont, and continues in it for a dtstance of 8.miles. After careful surveys, it was found that a line for the distance named could be built cheaper in Maryland, and, after being built, maintained cheaper than in West Virginia.

The maximum grade on the whole line is less than indicated by the preliminary survey, being, on a definite location, 70 feet per mile, with which the summit of the Alleghanies is reached and crossed near Fairfax Stone. This grade is in favor of the trade, and from 30 to 40 per cent lighter than the grades used by the trunk lines in crossing the Alleghany Mountains.

Examinations are being made in the Upper Potomac Coalfields for the purpose of ascertaining the extent and dip of the coal veins, with a view of opening them and being ready to ship coal by the time the road reaches there.

As to the extent and quality of the coal in that region, I refer to the condensed reports of Mr. Owen Riordan, late Inspector of Mines for the State of Maryland, and Prof. Pumpelly, of the U. S Census Commission.

Mr. Riordan, in his report of mining operations the last half of 1881, says:

I worked on a portion of Grant, Tucker and Preston Counties, W. Va. Commencing at "Fairfax Stone," I opened on what I call the "Fairfax and Dobbin house coal region"—which is about 9 miles long and 8 wide—ten different veins of coal, the thickest being 11 feet and the smallest 4 feet, measuring in the aggregate 52 of coal.

These veins of coal are of a different quality, some gas; some bituminous, and one vein of good coking coal. They are so situated, one above the other, that any one of them (or all of them together) can be worked without interfering with any other.

This is the most remarkable coal region so far discovered in this of any other country. I have neither seen nor read in the reports of any other person of a coal region having as much coal in it as this, and the whole of it is free from slate, bone coal, or any other impurities. This is neither exaggeration nor delusion, as all the veins are opened so that any expert can examine them. He will find them to be just as I have stated. There is a 9 foot vein of steam coal in this region that fully equals the Cumberland coal.

We opened on the second division of this West Virginia coal-field—which lies between the Dobbin and Kent roads and the mouth of Buffalo creek—eleven different veins of coal, ranging in thickness from 3 to 6 ft. This coal is semi-bituminous in quality, except one vein, opened at the head of Elk run, of cannel coal, 3 ft. thick. The coal in this division is also free from all impurities.

The coal area is a thick forest almost covered with spruce and hemlock, the trees being of an enormous size and good quality, making it as superior in its timber as it is in coal.

Prof. Pumpelly, under date of May 17, 1882, writes:—On the 23d of March last I sent in my report on the coal of the Upper Potomac and Stony River basin, I beg to present herein a brief summary of the conclusions arrived at.

1. The Upper Potomac and Stony River basin, above the mouth of Stony river, contains at least 250 square miles of coal land, after allowing for the erosion of the valleys.

2. This area is underlaid by a group of several seams belonging to the lower part of the lower productive coal measures.

3. My examination did not enable me to state the number of workable seams, nor the total thickness of merchantable coal; but I saw beds of workable thickness (3 to 9 ft. thick) at so many different points, that I think is safe to assume that the whole area is underlaid by coal of workable thickness.

4. At the sounhern end of the field, where more exploration has been done, I examined three seams of workable thickness, two of which, with an aggregate thickness of 8 feet, are remarkably fine coal both for steam and for coking, and very low in sulphur.

6. I should put at the minimum figure of 2,000,000,000 tons the amount of coal in the beds of workable thickness in the Upper Potomac and Stony River basin.

All of this is above drainage and accessible from the valleys, and I think we may assume that at least one-half of it is available good coal.

Further exploration will, I think, prove the existence of even greater thicknesses of this excellent coal under portions of the basin. But enough is now known to prove that it has the basis for a great mining and carrying industry. This basin contains far more steam and coking coal than any other east of the Alleghanies outside of the Cumberland or Piedmont basin; and it is also considerably nearer tide water than any other. Its coal and coke will have a very extensive market for steam purposes and iron smelting respectively.

President Davis concludes:—In the administration of the affairs of the company, the management has adopted the policy of making moderate charges for freight and passengers, believing this the best means of early developing the coal, iron ore, timber and agricultural interests on its line, and which policy will be continued with the approval of the board. Most of the officers of the company being largely interested, as heretofore reported, the president, vice-president, general manager, secretary and treasurer have made no charges for their services, nor do they expect to before the company declares a dividend; nor is the company under charge for rent of offices in Piedmont, Baltimore or New York.

The offices of this company are at Piedmont, W. Va , and 92 Broadway, New York city; its officers are: H. G. Davis president; S. B. Elkins vice president; Augustus Schell, Wm. Keyser, Thos. B. Davis, Alex. Shaw, S. B. Elkins, Jas. G. Blaine, J. N. Camden, T. E. Sickles, W. H. Barnum, and John A. Hambleton, directors; A. Ebert secretary, C. M. Holt treasurer, and T. E. Sickles chief engineer.

Up to February 10 this company had this year (1883) sent to market, via B. & O RR., 19,450 tons of coal from its Elk Garden and 6,029 from its Big Vein Co. mines,—a total of 25,479 tons in 6 weeks, or at the rate of over 200,000 tons a year.

The Fairfields Coal Co., the one that has leased coal lands from the Cabin-creek Kanawha Coal Co., and the Williams Coal Co., of Kanawha—has begun the shipment of coal over the Kanawha Ry., the one up Cabin creek from the Ches. & Ohio and the Great Kanawha river, as we are informed by a party in interest. Cabin creek coal basin is one of the very best in the Great Kanawha coal-field, one where the dividing ridges are very high and where the coal beds of the Middle Measures (No. XIII) appear to be at their best in thickness and quality. We are pleased to be able to record the beginning of the development of this important region.

The Virginias.

No. 39. Vol. IV.—No. 3.

Staunton, Va., March, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

Errata.—On page 41, 2nd line of table, West Va. coke, under "pounds in one cubic foot, Dry," for 52.41 put 52.54; and under "percentage, coke," for 61.32 put 64.32; 5th line, Cumberland coke, under "grammes in one cubic inch, Wet," for 31.63 put 21.63.

The Spring Meeting of the American Institute of Mining Engineers this year will most probably be held at Roanoke, Roanoke county, Va., as a central point, but including running and halting sessions all along the 770 odd miles of the lines of the Shenandoah Valley and the Norfolk & Western railways and their branches in Virginia (including a few miles in Maryland), for we learn that the free use and hospitalities of these great railways, the hospitalities of Roanoke, and those of the mining, furnace, and other companies on these railways, have been tendered to the members of the Institute and the acceptance of them urged in a way that hardly admits of a rejection. The meeting will probably take place the last week in May—May 28-31 and June 1-2—the initial one taking place at the noted Luray Inn, Luray, Page county, Va.

The furnaces, etc., that are now accessible, by the cars of these railway companies, are among the most interesting to mining engineers of any in the country, and the scenic attractions of the regions they traverse can challenge comparison with any in the Union.—The Virginians promise that the Second Virginia meeting shall be an improvement on the First.

Prof Fontaine's Notes, page 42, occupy considerable space in this issue, but we are sure that no one desiring accurate information concerning the great iron, manganese and other ore deposits of Virginia that exist along the western base of the Blue Ridge in this state, for a distance of fully three hundred miles, will regret the length or fullness of this article. Prof. Fontaine sets forth, very clearly, the place of these ores in formation No. I, and the conditions in which they are found, illustrating his statements by careful descriptions of individual mines and openings.—While we do not concur in all his views in reference to the origin of these ore deposits, we do so heartily in his general statements concerning them, and commend these to the thoughtful study of the many that in Virginia are now mining these superior Primordial ores.

Connellsville vs W. Va. Coke.—On pages 40-41 of this issue we print in full the paper of Mr. John Fulton, Gen. M. Eng. of Cambria Iron Co., on the relative merits of Connellsville and New River, W. Va. cokes, as promised in our last.

We had gathered the materials for a review of and reply to Mr. Fulton's highly valuable and interesting paper—one that all our coke and furnace men will read with great interest—but were unwilling to publish it until assured by Mr. Fulton himself that his paper had been correctly printed by the "Keystone Courier," especially the tables, as the copy of that paper from which we took Mr. Fulton's article was badly printed. Our enquiry in reference to this and other points in his paper found him absent, as the following extract from a letter indicates, necessitating, from the lateness of its arrival, the postponement of our reply until next month.—The "errata" on page 33 of this number show that our apprehensions were well founded. The reader will please make the corrections indicated on page 41, which had to be printed before the arrival of the corrected copy—which we notice is a pamphlet issued in handsome style by the H. C. Frick Coke Co. as an advertisement of Connellsville coke, with the title page, "Furnace Fuels. Connellsville Coke Superior. Why it is better than other Coke and Anthracite Coal. The four prime requisites of good coke explained," etc.

Mr. Fulton writes as follows, under date of March 29:—"I find your esteemed favor of 13th ult. on my return from Cambria Iron Co's iron ore mines in the Menominee region in Mich. I got home yesterday afternoon. The W. Va. coke in 2nd column of table was from Fire creek, M. E. Miller, of your place, manager; analysis by J. B. Britton of Philadelphia, physical tests by the writer; analysis and tests made March 3, 1879. I made Mr. Miller a report of the the relative value of his coke at that time, ranking it next to Connellsville. The samples examined from the Connellsville region were from the P. & C. Gas Coal and Coke Co., John Dravo agent, from the works of Frick & Co., and from the works of Cambria Iron Co. There is substantially no difference in these cokes. I send you the article in pamphlet form, also a Scotch pamphlet on a kindred subject.

I am no chemist, only a mining engineer. The study of coke came from the poor character of some made by this company. I have no desire to interrupt your discussion of this important matter, only to direct attention to the requirements of coke fuel for blast furnace use."

The pamphlet edition of Mr. Fulton's article states that the Connellsville coke used in the "E." furnace, mentioned at bottom of page 40 of this number, was from the works of H. C. Frick & Co.

Appreciation.—A gentleman from the North, who has charge of the construction of a large work in Virginia, says, in a letter to the Editor: "You are entitled to every success for undertaking to publish so extremely valuable a paper. It furnishes what Virginia needs the outside world to know. The state could well afford to subsidize your paper. The Treasurer or Commissioner of Lands should buy and send away 2,000 copies or more a month. It is of more importance to the state than all the local gossip town papers together. If the state would spend more for information and less for politics it would be vastly benefited.

Coal and Coal Traffic of the Ches. & Ohio Ry., Feb., 1883.—General Manager C. W. Smith sends *The Virginias* the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during February, 1883 and February, 1882, in tons of 2000 lbs., compiled by fuel agent C. M. Gibson:

Kind.	February traffic			
	1883.	1882.	Incr.	Decr.
Cannel	3,039	1,417	1,622	.....
Gas	26,677	23,846	2,831	.....
Splint and Block	9,393	12,762	.....	3,369
New River, &c	34,201	27,598	6,603	.....
Coke	9,993	8,754	1,239	.....
Totals	83,303	74,377	12,295	3,369

The net increase of February, 1883, over February, 1882, was 8,926 tons, or a gain of a little over 11 per cent. The gain was in the movement of cannel, gas, and New River coals and coke, a large proportion of it was in New River coal, in which the increase was nearly 24 per cent.

Distribution of above for February.	1883.	1882.
1. To C. & O. Co. for its own use	14,215	13,503
2. To Huntington, for West via Ohio river	251	6,889
3. On Elizabethtown, Lexington and Big Sandy RR	3,705	6,763
4. On Ches. & Ohio Ry., excepting Richmond	16,906	15,840
5. To Richmond & Alleghany RR. at Clifton Forge	984	1,435
6. To Valley RR. of Baltimore & Ohio at Staunton		258
7. To Shenandoah Valley RR. at Wayneshoro	105	507
8. To Va. Midland Ry. { At Charlottesville	5,413	1,794
8. To Va. Midland Ry. { At Gordonsville	.....	20
9. To Richmond, Fredericksburg & Potomac RR. at Junction	491	1,697
10. To Richmond for consumption, including tugs, &c	12,258	10,305
11. To James R. wharves for shipment	2,447	15,366
12. To Newport News { For consumption, including tugs, &c	35	.....
12. To Newport News { For shipment	26,177	.....
Totals	83,303	74,377

The above shows that over 31 per cent, or nearly one-third of the coal moved by this railway in Feb., 1883, was sent to Newport News. A reference to page 25 of this volume will show that in Jan., 1883, the movement of coal to Newport News for shipment was 16,912 tons; so the Feb., 1883 movement to that point was 9,265 tons, or over 54 per cent more than that for January.

The following table presents the progressive traffic from January 1, to February 28, inclusive, for 1883 and 1882.

Kind	1883.	1882.	Increase.	Decrease.
Cannel	4,711	2,876	1,835	.....
Gas	51,294	37,708	13,586	.....
Splint and block	23,048	29,160	.....	6,112
New River, &c	65,438	53,600	11,838	.....
Coke	19.441	18,020	1,421	.....
Total	163.932	141,364	28,680	6,112

This shows a net gain for the two months of 1883 of 22,568 tons, or about 16 per cent, over the same months of 1882. Judged by the returns of January and February, the fuel movement of the C. & O. for 1883 will be 983,592 tons.—We are inclined to believe it will be near 1,250,000.

Coke Making in Virginia 1880 appears in the Compendium of the 10th census in a statement that she had 2 coke making establishments, having $30,000 capital, that were not in operation during the census year. One of these we know was at the Midlothian coal pits, Chesterfield county.

At this writing there are in Virginia: the large coke works of the Low Moor Iron Co., at Low Moor, Alleghany county, on the Chesapeake & Ohio RR., now in full blast, and the extensive ones of the S. W. Va. Improvement Co., at Pocahontas, Tazewell county, on the Norfolk & Western RR., now being completed and that will be in full blast some time in May.

The Coal Section at Crown Hill, Kanawha county, W. Va, on line of Ches. & Ohio Ry., measured by Engineer O. A. Veazey in 1876, and furnished *The Virginias* by Supt. Brewer Smith, is as follows, from the top downward:

1	The Black Flint ledge		
2	Shales and sandstones	40′	
3.	*Splint coal*		4′
4	Shales and sandstones	180′	
5.	*Coalburg coal*.... Coal 7′ 6″ / Slate 1′ 0″ / Coal 1′ 6″		9′
6.	Shales, etc	30′	
7.	*Winifrede coal* (On Paint creek front 4′ 8″)		3′ 7″
8.	Shales, etc	80′	
9.	*Coal*, with 4 thin bands of slate		5′
10.	Shales, sandstones, etc	220′	
11.	*Cedar Grove coal*		3′
12.	Shales, etc	50′	
13.	*Coal*, (thin *cannel* bench at bottom)		2′6″
14	Shales, etc	30′	
15.	*Blacksburg coal*		2′11″
16.	Shales, etc. to Kanawha river level	160′	
	Total thickness of coal beds in 700′ of section		30′

Altitudes of Streams where crossed by Chesapeake & Ohio R'y.—We are indebted to Mr. M. A. Miller, C. E., for the following altitudes, or elevations above mean tide, of the surface of streams crossed by the Chesapeake & Ohio Ry. between Newport News, Va., and Catlettsburg, Ky., prepared in the engineer office of C. & O. Ry. by Mr. J. J. Lyell, C. E. of eastern division of that railway.—The altitudes are in feet.

1. *In Virginia.*

Chickahominy river	87.00
South Anna river	32.00
Little river	39.84
Rivanna river, Albemarle Co	287.60
Mechum river, Albemarle Co	450.90
South river of Shenandoah, Augusta Co	1261.55
Middle river " " "	1560.00
Little Calf-pasture river of James, Augusta Co	1491 00
Big Calf-pasture river of James, Rockbridge Co	1379.00
Cow-pasture river of James, Alleghany Co.,	1071.00
Jackson river of James, Alleghany Co, 1st crossing	1047 00
Do " " " " 2nd "	1155 00
Do " " " " 3rd "	1214.00
Dunlap cr. of Jackson river, Alleghany Co, 1st cross'g	1228 00
Do " " " " " 2nd "	1251 00
Do " " " " " 3rd "	1293 00
Do " " " " " 4th "	1306.00

2. *In West Virginia.*

Greenbrier riv of Kanawha, Greenbrier Co., 1st cross'g	1656.50
Do " " " " 2nd "	1608.00
Do " Summers " " 3rd "	1486.00
New river of Kanawha, Fayette Co	770 50
Cabin creek of Kanawha, Kanawha Co	577.93
Coal river of Kanawha, " "	548.23
Hurricane creek of Kanawha, Putnam Co	608.73
Mud river of Guyandot, Cabell Co.—1st crossing	555.73
Do " " " " 2nd "	500.73
Guyandot river of Ohio, " "	502.73
Ohio river at Huntington, " "	501.73
Twelve-pole creek of Ohio, Wayne Co	511.50
Big Sandy (Chaterawha) river, Wayne Co	501.73

These altitudes are valuable for reference or datum points to those exploring the country near them.

The U. S. Geological Survey in the Virginias in 1883.—We learn, with very great gratification, from official sources, that the plan of field operations adopted for this year, 1883, means a large amount of field work in the Virginias. Director J. W. Powell, in the exercise of his characteristic energy and determination to give the country immediate results—those that will have a present value—has decided to put a dozen topographichal parties into the region bounded, in a general way, by the Blue Ridge on the southeast and the Ohio on the northwest, the Kanawha and its upper portion, New river, on the northeast and the Big Sandy (Chaterawha) on the southwest, a territory some 40 miles wide on the Ohio and 70 on the Blue Ridge, and having an average length of 150 miles, and embracing near 3000 square miles of Virginia and 6,000 of West Virginia.

The field of this survey will probably embrace most, if not all, of the Virginia counties of Montgomery, Pulaski, Wythe and Smyth in The Valley, and Giles, Bland and Tazewell in Apalachia, and the West Virginia counties of Mercer, Summers, Raleigh, Wyoming, McDowell, Logan, Boone, Fayette, Kanawha, Lincoln, Wayne, Cabell, Putnam and Mason.

Over half of the region in question is drained by the Great Kanawha river and its tributaries from the southward, such as New river and its Bluestone, Glade, Piney and Loup branches, and Loup, Paint, Cabin, Davis and other creeks, and Coal river that flow directly into the Kanawha; also the entire basins of Guyandot river and Twelve-pole creek and the part of the basin of the Big Sandy embraced in West Virginia.

It would be difficult to find in this country a region of equal extent that is at this time attracting more attention or one in which more important railways are deeply interested, railways now in operation as well as railways, based on its resources, that are projected. The Norfolk & Western RR. crosses its southeastern portion with its main line and reaches far into it with its New River or Flat-top coal-field branch; the Chesapeake & Ohio Ry. runs along most of its northeastern border and crosses its northwestern; the Central Ohio RR. also runs along a portion of its northeastern border; the Chattaroi RR. of Ky., runs along part of its southwestern border; and into it extend the Morris creek, Paint creek, Cabin creek, Fields creek and Davis creek railways from the line of the Chesapeake & Ohio Ry. It is probable that railways will soon be constructed up Bluestone, Coal and Guyandot rivers,–in fact arrangements are nearly made for the one up Coal river. The interests of all these railways will be greatly promoted by this survey and we would urge each one of them to aid, in every way possible, in expediting the work of the survey, that its results may speedily become available in the development of the vast resources of this almost unknown region of country.

Of course most, if not all, of the season's work will be topographical, for there are no printed maps in existence of any portion of this extensive territory that could be used as a basis for reliable geological work. The only reliable materials now available are the Confederate surveys of Montgomery and Wythe counties, the surveys of Kanawha river, (including New river), and of the Ohio and Chaterawha, (Big Sandy) by engineers of the state of Virginia, and of the U. S.; the survey of Guyandot river by the U. S. Engineers, the surveys of part of Coal river by the Coal River Improvement Co.; the surveys of the Bluestone Flat-top Coal Co., the surveys by made the railways above mentioned, and the triangulations of the U. S. Coast and Geodetic Survey.—All these materials the U.S. Geological Survey now has in hand and under the direction of Chief Geographer Hy. Gannett they are now being put on map sheets to be filled out from the surveys soon to begin.

This Kanawha-Chatarawha region—as it might be called—is a deeply interesting one for geological explorations, since in it there are ample exposures of all the rocks from the Archaean to the Permian—from No. I to No. XV or XVI of the Virginia series—presenting grand and remarkable foldings, faultings, dislocations and erosions. Prof. Wm. B. Rogers and his assistants, during the Virginia survey of 1835–41, made numerous carefully worked out sections across this territory, from the Blue Ridge to the Ohio, which have not yet been published, though they will be soon, but much of it is an unexplored field, one from which rich geological results may be harvested.

The Southwest Virginia Improvement Company is an organization, composed principally of Philadelphia parties, that will soon become widely known now that the New River Division of the Norfolk & Western Railroad is completed and the Flat-top coal and the coke made from it, from the mines and ovens of this company at Pocahontas, will soon appear in the markets and be used in the blast furnaces of Virginia and other states.

This company has been at work for some time at Pocahontas opening its mines in the "big" 12-feet or No. 3 bed of the Flat-top coal-field, as our readers have been informed from time to time, and early in April it will be ready to ship at least 300 tons a day of superior New River coal from its mines, and in a short time 1,000 tons or more a day. Its 200 coke ovens will soon be ready for use, and early in May it will be ready to furnish coke to meet its contract with the Crozer Iron & Steel Co., for its new 100-ton furnace at Roanoke, and to other furnaces, etc

This company owns large bodies of coal lands at and near Pocahontas and some of these it has improved, by opening drifts, chambers, etc., and by constructing sidings and tipples and erecting houses for operatives, so it can at once do a very large coal mining business and furnish a large amount of tonnage to the Norfolk & Western and help to satisfy the very great demand that now exists for the highly esteemed semi-bituminous coals known in the markets as New River coal. Its coal mines and coke ovens at Pocahontas are 120 miles from Roanoke, 174 from Lynchburg, 298 from Richmond and 378 from Norfolk.

This company has also been engaged for some time in mining and shipping to steel works in Pennsylvania, from its mines near Ripplemead, on this New River division, large quantities of high grade Bessemer iron ores.

The officers of the Southwest Va. Improvement Company are: John P. Ilsley president, Edward J. Collins secretary and treasurer, Edward S. Hutchinson sales agent, with offices at 37 S. 3rd St., Philadelphia; Wm. A. Lathrop superintendent of coal and coke department, Pocahontas, Va., and James Witherspoon superintendent of iron department, Pearisburg, Va. Its directors are Edward T. Steel, Stephen A. Caldwell, Clarence H. Clark, E .A. Rollins, Alfred Earnshaw, Charles Hacker, Edward W. Clark, John P. Ilsley and Thomas Graham.

Mr. Ilsley, who has recently taken charge of the affairs of this company, was formerly president of the St. Paul & Duluth RR., and recently assistant president of the Lehigh Coal & Navigation Co., and of the Lehigh & Susquehanna Railroad Co., so he has had a large and successful experience in the mining, tranportation and marketing of coal. Mr. Edward S. Hutchinson has been superintendent of the mines of the Cannelton Coal Co., at Cannelton, on the Kanawha, W. Va., where he acquired an enviable reputation as a coal operator from the energy and success of his management.

The so-called Alleghany Mountains of Montgomery county, Va., a mere water-parting ridge in The Great Valley, is one of the most absurd examples of our geographical nomenclature, one that ought long ago to have been disposed of, but which the people of Southwest Virginia cling to with undying pertinacity. The following extract from the 1835 Virginia Geological Report of Prof William B. Rogers, presents the views of that famous geologist on this question. We commend them to the consideration of those believing in the existence of such a mountain range.

"Through an exclusive attention to the direction of the drainage of the northern and eastern portions of this division of the state—as, for example, in Montgomery county—the designation of Alleghany has been very strangely and unphilosophically applied to a comparatively elevated portion of the table lands of that county—and guided by the same principle, in tracing a supposed connected chain which forms the water-shed of both the east and west discharging rivers, the same title has been applied to a portion of the Blue Ridge, constituting the western boundary of Patrick and Grayson counties. Thus we have the same term applied successively to ridges entirely dissimilar in regard to the materials of which they are composed, and the epochs to which they are geologically to be referred; and what is of much more practical importance, mistaken conceptions of the nature and resources of these districts will be almost certainly suggested, on a first view of them, as delineated upon the map, from the prevailing idea, that a continuous mountain chain, thus bearing a common designation along its entire extent, must, of course, exhibit great similarity in structure and materials throughout all its parts. Nor is this all: by following the fallacious guide of the direction of the drainage, instead of actually tracing continuous ridges, likely to present a general similarity in character throughout, we are in many cases giving an imaginary continuity to elevated portions of land frequently belonging to successive ridges, and thus creating in imagination a connected mountain in a direction or directions in which none such actually exists.—Hence, nothing is more common in descriptions than to hear of the Alleghany *passing under* the Peters mountain, near the Sweet springs, traversing the various ridges to the east until it arrives at Christiansburg, and thence by many crooked courses, tending towards the Blue Ridge, until reaching that mountain, it suddenly cuts it off, and bends its own course to the south-west.

But during all this description, the speaker is seldom aware that he is describing what to a great extent has no original in nature. and that which he represents as one mountain, a continuation of the great Alleghany of the upper and middle portions of the state, here striking across the numerous ridges to the east, and making its way in that direction under and over and through the numerous mountains which seem crowded in a phalanx to resist its course, is in reality, through much of its extent, only a series of spurs, sometimes merely elevated table lands, dissimilar in structure and origin amongst each other, and only associated in an imaginary connection by the accidental circumstance that they form one portion of the water-shed of the east and west-discharging rivers. A more accurate knowledge of the topography of the state, and more judicious principles in the application of terms, will, it is hoped, at some future day, correct this preposterous error in the designation of our mountains, and will substitute on our map such names as the real constitution of ridges of analogous formation throughout, would render natural and appropriate. Thus the western boundary of Patrick and Grayson ought to be called Blue Ridge, and no ridge or mountain east of Peters mountain, can, with the least propriety, be entitled Alleghany."

The Kanawha Coal Region.—Almost every section of our land has some leading branch of industry, such as wheat growing, wool growing, raising cotton, or the manufacture of iron, on which its prosperity depends. It is evident that the great industrial and commercial interest of the Kanawha basin is in coal. Already mining, making coke and shipping coal are carried on upon an extensive scale. And yet this interest is comparatively in its infancy.

It is of great importance to us, as a people and community, that the truth should be published in regard to our coal interest, as to its quantity, quality, and shipping facilities. Exaggerated accounts published and sent abroad over the land, may injure us, as well as statements under-rating our mineral region. For instance, statements have been recently published that we have 90 feet of coal above the level of the river. Our wealth in coal is very great and its extent is not yet known, and we may keep within the bounds of truth and still show the almost inexhaustible supply of this mineral. Mr. Jed. Hotchkiss, editor of *The Virginias*, deserves the thanks of all our people for the valuable information he publishes from actual measurements, and a geological knowledge of the Kanawha basin.

Some persons may even be misled by seeing true statements of the aggregate thickness of our coal beds, under the impression that it is all workable coal. For an example, Charles C. Lewis, Esq., of our city, made a measurement of the coal-beds above low water mark on the Kanawha river opposite Coalburg. His measurement of 14 distinct beds of coal amount, in the aggregate, to 55 feet On the ground that a vein less than three feet thick cannot be worked profitably, five of these veins are useless, and one of five feet in thickness is so mixed with iron and slate as to be worthless. This would leave 8 beds with an aggregate of 35 feet of workable coal. The measurements made by Capt. Page, at Hawk's Nest and vicinity, show 68 feet four inches thickness of coal. Deducting veins not of sufficient thickness for mining, we have left about 55 feet of workable coal.

In the Kanawha and New river coal-fields there are now 55 collieries. To these may be added a number of mines that produce no inconsiderable quantity for local consumption, and the great Flat-top mines which also belong to the Kanawha basin. This makes at least 60 collieries which produce daily about 15,000 tons of coal, or 4,500,000 a year, or as Kanawha river men would say, 126,000,000 bushels a year.

The greater part of these collieries have been established within the last few years. Twelve years ago we heard the names of Dana, Edwards, Donnally and a few others mentioned as coal operators. Now they number 60 and every year adds new companies to the list. Shipping coal is an important part of our river business. Between Cannelton and Raymond City there are 13 steamboats owned and employed in towing coal barges down the Kanawha and Ohio. Eight of these have a towing capacity respectively of 15 barges, each containing from 10,000 to 12,000 bushels, one of them of 20 barges, one of them 18, and three of them from 8 to 10 barges. These boats, all moving at once, would carry out of our river at a single trip 1,880,000 bushels of coal. Thousands of bushels are also shipped to the eastern markets daily by the C. & O. Ry. Yet we may say that the greater part of our coal-fields has not been touched. From Sewell mountain to Putnam county not only on New river

and Kanawha, but on Gauley, Coal and Elk lie rich beds of this mineral, vein above vein. They are almost continuous with the vast beds of sandstone which spread over nearly the whole region, in horizontal plains. Mr. Hotchkiss does not exaggerate when he speaks of this as "the most extensive and most coal abounding of the coal basins on the American Continent."

But if the quantity is inexhaustible the quality is unsurpassed. On account of its purity it scarcely finds a rival,and owing to the different varieties it is adapted to all purposes. From the hard semi-bituminous splint to the soft bituminous gas coal, you can find fuel adapted to every use. Prof. Egleston, of Columbia College, New York, visited our coal fields in the summer of 1879. In writing of them afterwards, he says, "I have found the coal that they yield exceedingly pure. None of them contain more than two per cent of ash, and are almost free from sulphur and phosphorus." With such stores of this mineral, in such variety and quality, it is no wonder that our coal fields are now attracting capitalists. In no part of our country does mining and shipping coal yield a larger reward.

Yet our coal interests are undoubtedly to be developed in a new direction. It is found that nearly all our coals are capable of making coke more like charcoal in its qualities than any that is to be found. It has been decided that Kanawha coke contains only one-half the amount of ash contained in the average of the Connellsville coke. For this reason it is more valuable in the manufacture of iron and a much less quantity is required to make the same amount of iron. Besides, the increasing demand and high price for coke will turn capital into its production, instead of shipping the coal abroad. In the great mining region of the west, Connellsville is depended on for coke and both on and off the line of the Pacific RR. they are paying from $25 to $40 a ton. The cost of this article has interfered seriously with treating the ores of the precious metals. Prof. Egleston says the superior quality of the West Va. coke, when it becomes known, must give rise to a very large coke manufacture in our region. This writer says that none of our coals adapted to this purpose should ever be allowed to go out of the country except as manufactured into coke. Already within the last three or four years 9 coke works have been established on New river and Kanawha with 609 ovens, producing daily 633 tons, or annually 207,900 tons. Undoubtedly this will be the great interest into which our coal is to be developed. And we predict that before many years the line of our railroad will be lighted for miles and miles with the fires of the coke ovens.

These industrial interests must not only bring capital, but men. To bring out this mineral so abundantly stored up in our hills, and convert it into the most merchantable form a swarming population will come. A continuous village will extend along the line of the C. & O. Ry. from one end of the coal field to the other. Our grain growing neighbors may talk about our barren hills, but we have crops beneath them which no frosts can blight, and harvests which no hail or mildew can destroy.—J. C. Barr in *The Cadet* of Charleston, W. Va.

Notes on Assaying and Blow-pipe.

By Alfred F. Brainard, Resident M. Eng. Low Moor Iron Co., of Va., formerly M. Eng. and Assayer in New Mexico.

The object of these notes is to present a few facts, not generally known to inexperienced assayers, whereby some of the known assay schemes may be shortened without rendering them less accurate, as well as to cheapen the process by economizing in fuel and fluxes.

In making an assay for silver, gold and lead, more especially for silver and lead, most assayers use a separate portion for each constituent, involving double the work and expense. By simply using ½ an assay ton (29.166 grams) or its equivalent in grains, of the ore to be assayed, and making the usual crucible assay for lead, viz:

½ A. T. Ore = (Pb S, $PbCO_3$ plus Al_2O_3 SiO_2, &c.)
1½ A.T. $Na(CO_3)_2$ = Bicarbonate of sodium.
Cover with Na Cl = Salt.

The ore and sodium bicarbonate are well mixed in a mortar and poured into the crucible, then cover with salt a quarter of an inch thick and stick down through the whole three 8- or 10-penny nails, points down, and then cover all with a clay or other cover and place in a coal fire; subject to high heat for about half an hour, or until quite fused and the appearance of white fumes. Then the cover is quickly removed, the nails pulled out, stirring them as they come out. The crucible is taken out and either poured into a slag mold or allowed to cool; after cooling the slag is broken away from the button of lead containing the silver and gold and it is hammered into a cubical shape, weighed and its weight in grams divided by 14.582 (½ an assay ton of ore was used) and the result multiplied by 100 gives the per cent of lead. This cube of lead may then be cupeled. The button of silver left is allowed to cool and is then weighed. The result in milligrams is multiplied by 2, which gives the number of ounces to the ton of 2000 lbs. of ore. This button is placed in a test-tube or parting flask and heated nitric acid poured on until it is dissolved. If any bluish black particles are left it is gold, which is washed, dried, ignited and weighed, and its weight subtracted from the original weight of the silver bead.

In many experiments with galena and other lead ores, I have checked this scheme as to silver and gold by other methods, and have found that ores ranging from 5 oz. silver up to 70 oz., and from 10 per cent of lead up to 70 per cent, the results are correct. When less than 10 per cent of lead is in the ore the ounces of silver may be doubtful, and the silver should be redetermined by using a fresh portion by the scorification or crucible assay, adding lead in some shape to produce a button weighing about 5 grams.

The following results illustrate the varying ratio of silver and lead in about 35 examples worked by this method and checked by some other method. The checks are here given:

Lead Per Cent.	Silver Ounces.	Lead Per Cent.	Silver Ounces.	Lead Per Cent.	Silver Ounces.
45.75	7.5	21.25	0.1	29.20	5.70
11.45	20	59.39	7.8	10.7	5
42.00	24	45	13.2	17	6.8
7.61	5.96	12	42	40.4	6
9	6.45	70	14	20	1.6
4	8.25	18.3	72	29.6	6
39	13.3	11	9	57	68.8
41	10.2	12	1.25		
22.75	16	63	0.5		
33 75	3	31	34		
34.3	1	45	10.68		

Some time ago the writer discovered a new flux for crucible assays which is given below for the first time to the profession.

This substance is a combination of the oxides and phosphates of lead and the phosphate of calcium. It is prepared by taking old cupels, which have been used and are thoroughly saturated with litharge. They are carefully selected, ground up in an iron mortar, sifted through an 80-mesh sieve, and it is ready for use. This flux is specially adapted to ores containing a large amount of sulphides and oxides of iron to be assayed for gold and silver by a crucible

assay. The following is an example of a charge which has been often and successfully used

½ Assay Ton of Ore, } Mix in a mortar and roast until
½ Assay ton Si O_2 (silica) } sulphur is driven off.

Charge.
½ Assay ton of ore, roasted
½ do do of silica, "
3 do do of sodium bicarbonate.
1 do do of pulverized cupels.
Salt cover.
3 Nails, points down.
Button of lead will weigh 11 grams.

This button can now be cupeled directly and the resulting silver bead weighed. Ordinarily about 50 grams of this pulverized cupels will give a button weighing 20.7 grams.

Every one making assays of iron pyrites will appreciate this scheme, as it gives very liquid slags, and the lead is easily reduced without cutting into the sides of the crucible. This flux may be used with many other classes of ores not containing much lime or alumina. Silica, as used in the above methods or in a scorification assay, can be easily prepared by selecting two or three large crystals, heating them to full red heat and then carefully taking them out and plunging them into cold water, and when cooled grinding them up in an iron mortar while still moist, then dry and sift through an 80-mesh sieve.

The powdered silica is used in all classes of assays when silicates of magnesia and alumina predominate.

It is never good to cupel as large a button as one can get into a cupel, or to be obliged to double cupels together in order to absorb the lead This plan prolongs the operation and incurs a liability of waste or loss. If the button is large it should always be scorified down in a scorifier, to a small button and then cupeled as quickly as possible.

An inexpensive and expeditious assay can be made by combining a crucible and a blow-pipe assay together, in a novel manner, as follows: Ores to be assayed for silver alone are ground fine and sifted until all passes through the sieve, then one-tenth of an assay ton of ore is weighed in a small hand or pocket scale, mixed thoroughly in a mortar with twice its weight of sodium carbonate, one and one-half times its weight of litharge (free from silver) or pulverized cupels, with a little borax or silica, if the ore is poor in silica, a little argols or flour, and covered with salt, and one nail struck down through the mass, the whole being placed in a small Hessian crucible and placed in an ordinary coal stove or grate and brought to a full red heat. After boiling has ceased and quiet fusion ensues the white fumes begin to come off, the crucible is then pulled out and poured into a slag mold, or it can be tapped quietly and allowed to cool, the crucible is then broken and in either case the slag is pounded away from the lead which is hammered into cubical form. A cupel, which must have more "body" than the ordinary blow-pipe cupel, is heated in a stove upon a thin iron plate and quickly placed into the cupel holder or stand, the lead cube is put into it and a flame produced by Fletcher's hot-blast blow-pipe and Fletcher's lamp, is forced upon the button, and by a continuous blast and constantly turning the cupel around to heat all parts of it equally. The button of lead is absorbed into the cupel and when the rotation of the button has ceased and the white oxide cloud has disappeared, the silver bead is allowed to cool, it is then detached and placed upon a bead scale made of ivory, and measured and calculated into ounces per avoirdupois ton of 2000 lbs. The cupel may be made without a special cupel mold or the ordinary iron cupel into which is pressed bone-ash by taking a narrow strip of tin, binding it together to form a ferule, which is soldered by first moistening with zinc chloride (made by dissolving zinc in muriatic acid), and then placing a drop of solder on the point, where the two ends meet. A jet of flame from the blow-pipe quickly solders it, then a little fine bone-ash is moistened and pressed in with a rammer and the cupel is made. This is allowed to dry naturally or artificially. By making a number at a time one can make a number of assays together. The ferule will become unsoldered when the cupel is strongly heated, but this matters not, as it served to make and hold together the cupel while being made. I have frequently made a complete blow-pipe assay without crucible with the blow-pipe and lamp above named, and reduced 1–20 of an assay ton of ore and cupeled it in one continuous operation; I have also cupeled down 5 grams of lead at once.

A pocket out-fit for making a blow-pipe assay or a combination blow-pipe and crucible assay, need not cost much. It is within the means of nearly anyone, and with a little patience and perseverance one can soon make accurate assays of ores ranging from 10 to 300 ounces. The approximate cost of such an outfit is as follows:

One small pocket ore scale, horn pans,	$4.50
One ivory bead scale	3.50
One Fletcher's blow-pipe lamp and hot-blast blow-pipe	2.75
½ lb. Bone-ash, 15 cts., 1 lb. carb. soda, 20 cts., 1 oz. borax, calcined, 10 cts	45
1 Pr. pinchers, 10 cts., 1 lb. test lead, 15 cts., ½ lb. litharge, 15 cts, 1 doz smallest crucibles, 25 cts	65
Total	$11.85

The weights, say two or three, can be made from pieces of sheet brass by some standard weights, and the cupel stand and rammer can also be made. A small hammer and anvil are useful. Fifteen dollars would cover all needed apparatus to make the blow-pipe assay. The whole can be carried around in one's pocket and used in any locality. Common coal oil, or kerosene, is as good as any other to use in Fletcher's lamp, and has the advantage of being easily procured.

Notes on the Geology of the Virginias.

Extracts from the manuscript Note Books of the Virginia Survey of 1835–41 by Prof. William B. Rogers.

(Continued from page 23.)

Formation No. VIII—the Chemung, 11 b. of the New York Survey, the Vergent of the First Pennsylvania Survey—is described by Prof. Rogers as follows:

Formation No. VIII, a deposit of slate and thin bedded, fine sandstone, is about 2,000 thick in the N. E. and about half that thickness in the S. W.

Slate is by far the prevailing rock in this formation; it is only prevented from being entirely so by thin compact beds, the material of which is very little coarser than that of the slate,—which in the middle and upper parts of the formation interrupt the continuity of the slate. The extreme lower part is entirely of slate. There is less of this in the middle than in the upper part. We will not have ascended far in the deposit before the continuity of the slate is interrupted by at first very thin beds at considerable intervals. As we ascend we observe the intervals narrower and the compact beds heavier. Such is the gradual increase and decrease until we pass the middle of the formation. When we have done this we find the order inverted; the compact beds now diminish in thickness and the intervals between increase in width. But this does not continue until the compact beds cease to exist; for before this could be accomplished a change took place in the material deposited. Generally this change was to coarser and more silicious matter. A decided change is exhibited in the color—which by the way is the most striking mineralogical difference—and by it we are frequently left to determine

the commencement of one formation and the discontinuance of another.

The slate resting upon No. VII is generally black and very fissile. As it becomes heavier and of coarser material the black color gives place to an olive green and brown color which continues to the termination of the formation. It sometimes happens that there is a little red slate in the lower part associated with the black. This I believe is more frequently the case in the S. W. than in the N. E. In the N. E. the black variety generally has a conspicuous development, and is frequently much compacted and finely glazed. When there is a good exposure of this variety it is most sure to tempt an excavation by its unfortunate proprietor with the pleasing prospect of arriving upon a rich supply of good coal. The quantity of pyrites and carbonaceous matter found in this strengthens the prospect when tried upon the fire.

In the compact beds—fine and coarse—and in the heavy slate there is much mica in minute scales; in the upper portion it sometimes occurs that the coarser of the compact beds are conglomeritic.

In the S. W. the diminution of the formation does not alter the characteristics; so that there we are presented with the same characters in a more limited deposit.

The formation diminishes rapidly S. W. from Wythe county, so that at Cumberland Gap no more than about 250 feet of it remains; and it is remarkable that in this diminished development the same features--in miniature to be sure—are presented as those by which it is made known to us at the Potomac river.

Fossils are not very abundant in this formation. When they are presented it is more frequently in the upper part than in any other, and it is a curious fact that when we find fossil shells they are presented in clusters, crowded close upon each other; and most of them are broken. I have never met with any other than fucoidal impressions of vegetable fossils.

Formation No. IX—The Catskill, 12, of the New York survey and the Ponent of the First Pennsylvania survey—is described as follows in Prof. Rogers' note-book:

No. IX is a formation of alternating sandstone and slate of great thickness—from 5,000 to 6,000 feet. It is remarkable for the prevalence of a deep red or brown color in both of the constituents of the formation.

In the remarks on the superior portion of the formation, which precede this, it was shown that it was by no means unfrequent that there was such a blending of the two deposits at their junction as to render it difficult to ascertain at what point the one terminated and the other commenced. But while this is often the case I think it is nearly as often when there is no difficulty at all. In this case there is a sudden change in the mineralogical character of the two formations —an abrupt passage from heavy olive green slate, with thin compact beds of fine material, to a coarse red conglomerate or conglomeritic sandstone. When the other is the condition, we are not left long in doubt; for the change in color and other mineralogical characters of the slates are quickly conclusive.

The two constituents of this formation vary in relative amount in different parts of it. In the inferior portion the slates predominate, while the sandstone is the most abundant in the superior portion. But I have never observed that one existed for any considerable distance to the exclusion of the other. In the lower part the sand beds are generally thin and comparatively far separated, while in the upper portion the reverse is the condition—the slates in thin beds and far separated. It is not always precisely as described; for often it is the case that there is more slate in the extreme upper part of No. IX than lower in the deposit. The exception in the lowermost portion is that the coarse sand beds or conglomerate is not a heavy one:—i. e. it is comparatively thin—say about 100 or 150 feet.

There is much variety in the texture of the rock in this formation. The sandstone is oftener friable or very moderately compact, than in the opposite condition. It is rarely that a vitrified appearance is presented. Much alumina prevails in these beds. The paste is oftener of this character than of a silicious. The softness arising from this condition, added to the deep red color, which often has a tinge of yellow, give a peculiar rich appearance to these beds. The slate, too, is peculiar to the formation, in the crumbly exhibition which most of it makes at the surface—arising from the thick laminæ falling to pieces in parallelopipedon fragments. It is often that we may observe a concentric structure in it when a good escarpment of its beds is exhibited; and these generally are very large. There is also much variety of color in this rock; exhibited in different shades of red in which are alternating beds of olive green and other shades of green. This often gives a beautiful appearance to a continued escarpment. There is a peculiar richness about this also which makes it interesting to look upon

The thickness of this deposit presents apparently very little variation in the N. E., but it diminishes towards the S. W. and towards the west or West—S. W. Of the modification in this last direction we have a remarkable exhibition by comparing its development in the Front Ridge of the Alleghany mountain and in the valley of Tygart river directly west. At the former locality we are presented with all the characteristics of the formation, as described above, remarkably full and plain; in Tygart valley there is a great falling off in thickness; a great want of red coloring matter; and a great want of heavy sand beds. Still, of course, there is a great similarity in general appearance. The varieties of green take the place of what is lost of the red color.

In the S. W. there is a great diminution in thickness; and this is the greatest modification which is presented here. It is probably about one-third as thick in Wythe and Montgomery as in the extreme N. E., and in the region of these counties and N. E. of them all the most characteristic features with this exception are developed—there should be an exception, at least in the depth of the color if not in the quantity of the red color. Southwest from this region the red matter is very deficient; there is a good deal of brown color and there is much of gray with a tinge of brown. There is not much of heavy material compared with the thickness of the formation or indeed compared with its entire thickness in the N. E. The heavy beds are more compact there (S. W. of Montgomery) than in the N. E.—more vitrified. There is another peculiarity there exhibited in the fragments piled at the base of steep escarpments, conspicuous among them are long prismatic pieces two or three inches in width and about one in thickness, of a gray color with a shade of brown. There is an irregular sharp angled cleavage in the heavier beds peculiar to this region;—this is not unfrequently conchoidal. There is less alumina in this region also and consequently a want of that peculiar richness presented in the middle and N. E. portion.

There is a continual decrease in the thickness of this formation to Cumberland Gap:—at that place it may be 300 feet in thickness, but I think it is less.

Fossils are not abundant in this formation in any district where it exists. When found they are mostly in the lower or upper part. There are generally bivalve shells or rings and segments of encrinites; and, as was observed of formation No. VIII, these are crowded in a small space. Fossil plants are occasionally found in the upper part of the formation.

Connellsville, Pa., vs. New River, W. Va., Coke.

By John Fulton, Mining Engineer.

My attention has been called to a friendly controversy now pending between the editors of "The Keystone Courier," of Connellsville, Pa., and "The Virginias," of Staunton, Va., on the important industrial question of the relative merits of Connellsville and West Virginia coke, for blast furnace use, in the manufacture of Bessemer pig iron.

I understand the grounds taken by the parties in this discussion rest upon the evidence of chemical analyses, especial emphasis having been laid on the relative volumes of *phosphorus*, the "Courier" asserting that the Virginia coke holds a larger percentage of this dangerous element than the Connellsville.

On the other side, "The Virginias" denies this, and submits analyses by Prof. A. S. McCreath, chemist of the Second Geological Survey of Pennsylvania, showing less phosphorus in the West Virginia coke. Neither party questions the accuracy of the chemical analyses of these cokes, but there are objections to the manner of quoting the results. "The Virginias" submits Prof. McCreath's analyses in report M. M., page 127, as showing 0.0344 per centum of phosphorus in Connellsville coke—the same authority finding only 0.008 per cent of phosphorus in the New River, West Virginia, coke.

It will be noted that Prof. McCreath *does not say* that the twenty-four coals examined by him from the Pittsburg coal bed *were all from the Connellsville region*. This large Pittsburg bed covers an extensive corner of the state on its southwest side. The inquiry now is confined to the Connellsville coal and coke region—not designed to embrace all southwestern Pennsylvania. Now in report M. M., coke from the large establishments of Messrs. Dravo, Frick and Company, which afford prominent types of Connellsville coke, the phosphorus is given at 0.0140 per cent.

Other Analyses.

A recent and exhaustive test for phosphorus has been made from a large sampling of the coke made at the extensive works of the Cambria Iron Company, near Connellsville, selected by John McFayden, superintendent of coke department, by Prof. T. T. Morrell, chemist, showing only 0.010 per cent of phosphorus. J. Blodget Britton, chemist, Iron Masters' Laboratory, Philadelphia, in his analysis of the coke quoted by "The Virginias," shows 0.027 per cent of phosphorus

We have, therefore, two determinations by different chemists of Connellsville and West Virginia cokes, as follows:

	Connellsville.	*West Virginia.*
A. S. McCreath,.....	0 014	0.008
T. T. Morrell.....	0.010	——
J. Blodget Britton.....	——	0.027

Showing an average of phosphorus in Connellsville coke 0.012, and in West Virginia 0.0175 Both of these cokes are low in phosphorus, and the slight difference in favor of Connellsville should not alone afford evidence of its superiority.

The following analyses of these cokes will show their relative composition:

	Connellsville	*West Virginia.*
Moisture.....	0.030	0.110
Volatile matter.....	0.460	0.350
Fixed carbon.....	89 576	92.181
Sulphur.....	0,821	0.618
a Phosphorus.....	0 014	*b* 0.027
Ash.....	9.113	6.680

a A. S. McCreath, M.M. page 107 and 127.
b J. Blodget Britton.

From the above it will be readily seen that there are no large differences except in the ash which is somewhat greater in Connellsville. This difference would not afford grounds for a claim in favor of West Virginia coke, for it will be shown that whilst purity is one of the prime factors in superior coke, yet there are other vital considerations that decide the value of this fuel for metallurgical purposes. The inquiry is here pertinent: *What constitutes superiority in coke for blast furnace use in producing Bessemer pig iron?*

In the preparation of coke for blast furnace use four conditions are regarded as essentials;

1. Hardness of body.
2. Well developed cell structure.
3. Purity.
4. Uniform quality of coke.

I. Hardness of Body.

The best coke must possess *hardness of body or cell walls*—not density, for dense cokes are frequently soft or punky, whilst hard cokes generally afford a well developed cell structure. These two physical properties, hardness and full cellular spaces, are correlated, just as softness and density are associated.

The prime requirement of *hardness of the body of coke* will be evident, when the conditions of its combustion in a blast furnace are considered. In its movement down the furnace, from the charging plates to a short distance above the tuyeres, it is enveloped in a current of hot carbonic acid gas. This gas possesses the power of dissolving carbon or coke and is especially destructive of the soft variety. Every pound of coke dissolved by this gas in the upper section of the furnace is a *double loss*, by the reduction of temperature where the action takes place, and in the loss of a pound of fuel, which should have been burnt near the tuyeres. I. Lowthian Bell has shown by direct experiment that all forms of carbon are not equally easily affected by carbonic acid; that *hard coke* is capable of resisting its solvent action much more than soft coke; the latter suffering by dissolution, during a test of 30 minutes, six times the loss of the former. (Bell's Iron Smelting, pages 413. 414.)

The value of a coke in a condition of *hardness* in which it is least susceptible of being oxidized, in the region of the furnace *where its combustion proves a double loss*, needs no further emphasis.

II. Well Developed Cell Structure.

Next to hardness of body in coke, a well developed cell structure is second only in importance. This arises from the fact that, other things being equal, the calorific energy of a fuel is in proportion to the surface exposed to the oxygen of the blast in the region of the tuyeres. Hardness with density of physical structure as found in anthracite, which is a natural coke produced under great pressure, illustrates this position conclusively by the actual work. The following records, taken from "The Iron Age" of January 4th, 1883, illustrate this difference in density with corresponding results in blast furnaces running on Connellsville coke and anthracite coal.

Connellsville Coke.

The run of the Carnegie Brothers & Co's Edgar Thompson E Furnace, at Pittsburg, for the three weeks ending November 11, was 1465 tons, 1629 tons and 1540 tons respectively. This output was on 54 per cent ore, and was made on 1 pound of coke to 1 pound of iron. Their D Furnace has made 299 tons in one day, 1840 tons in seven and 7332 in 31 consecutive days. The ton used is 2268 pounds.

Anthracite Coal.

The yield of pig iron at Colebrook Furnaces during the week closing Saturday, Dec 16, was 577 tons at No. 1 Furnace and 575 tons at No 2 Furnace. The total yield for the week from both stacks was 1152 tons. No 1 Furnace has been in blast fourteen weeks, and has produced in that time 6446 tons of pig iron, averaging 460 tons per week. No. 2 Furnace has been in blast 5 weeks and produced in that time 2389 tons, averaging 478 tons of pig iron per week. Cornwall ore was used exclusively; the fuel used was anthracite. These are the two new furnaces of Robert H. Coleman, at Lebanon, Pa. No. 1 is 55 feet high by 14½ feet in diameter; No. 2 is 80 feet high and of the same diameter as its mate. The ton used contains 2250 pounds.—*Iron and Steel Bulletin.*

Without insisting on the very large product of these coke furnaces, it is submitted that, other conditions being equal, the average energy of these fuels would be represented as follows:

Coke furnace, 800 tons of pig iron per week.
Anthracite furnace, 500 tons pig iron per week.

This exhibits a relation of Connellsville coke to anthracite coal of 8 to 5. A careful test of two cokes differing in density, made at Conemaugh furnace, showed a loss of 11 per cent in product arising from the denser coke alone.

The following table will illustrate the physical properties of Connellsville, West Virginia, and other cokes for general comparison:

Table Exhibiting the Physical and Chemical Properties of Coke.

Locality.	Grammes in one Cubic Inch.		Pounds in one Cubic Foot.		Percentage.		Compressive Strength per Cubic Inch (¼) Ultimate Strength.	Height of Furnace Charge Supported Without Crushing.	Order in Cellular Space.	Hardness	Specific Gravity.	Chemical Analysis.						Remarks
	Dry.	Wet.	Dry.	Wet.	Coke.	Cells.						Fixed Carbon.	Moisture.	Ash.	Sulphur.	Phosphorus	Volatile Matter.	
Connellsville	12.46	20.25	47.47	77.15	61.53	38.47	284	114	1	3.50	1.500	89.57	0.30	9.11	.82	.014	.460	Chem. Analysis, Prof. A. S. McCreath
West Va	13.76	21.19	52.41	81.56	61 32	35.67	258	103	1	3.15		92.18	0.11	6.68	.618	.027	.350	" " J. B. Britton.
Broad Top..	11.76	20.18	44 81	76.88	58.27	41.73	240	96	1	3.35	1.342	89.28		8.66	1.06			" " T. T. Morrell.
Clearfield ...	14.72	19.86	56.35	76.69	74.43	25.57	319	128	1	3.60	1.560	89.86	0.54	9.41			.667	" " Booth, Garrett & Blair
Cumberland.	12.71	21.63	48.61	82.41	58.99	41.01	215	86	1½	3.00	1.750							Soft Coke.
Alabama....	13.30	18.29	50.70	69 01	73.17	26.23	225	87	1	3.50	1.493							Good Coke.
Illinois.....	11.06	17.01	42.02	65.09	63.79	36.21	180	70	1	3.20	1.215	89.77	0.12	9.58	0.93	.033		" " T. T. Morrell.

Jno. Fulton.

From a careful inspection of this table, which affords a wide range of typical cokes, it will be seen that whilst some approximate very closely to Connellsville in certain physical and chemical properties, yet no one inherits so many essential requisites in equal degree with it.

III. Purity.

It has not come under the writer's observation that any comprehensive law has been eliminated, from reliable determinations, locating the greatest volumes of sulphur or phosphorus in any special zone of the Apalachian coal field. Sulphur, free or combined with iron, is mainly found in the coal slates. In some instances these slates are interleaved in very thin plates with the coal, so as to render washing unsatisfactory. In other coals the pyrites are found in lenticular pieces which are readily removed by crushing and washing. Hence it follows, in a general way, but not always, the more slate the more sulphur. Mr. McCreath has shown that twenty-five coals examined, containing an average of 2.138 per cent sulphur, yielded cokes containing an average of 1.912 per cent of sulphur.

Phosphorus is a more difficult element to locate. The inquiry as to its relative volumes in the coal and its slates will probably be answered when Prof. J. P. Lesley arranges the valuable data now being collected in the Second Geological Survey of Pennsylvania. Mr. Britton found in two samples of anthracite coal for furnace use, ash 10.43; phosphorus, 0.049; and ash 5.29; phosphorus, .0354. In examining two semi-bituminous coals, he found in one, ash 5.03; phosphorus .0085; and in the other, ash 4 94, and phosphorus only a trace. (Am. In. M. E. Vol. I page 298.) In a recent series of tests for phosphorus in brown hematite iron ore, an average of .099 was found in clean ore, .068 in the clay in the ore and .012 in the rock matter associated with the ore.

One general principle can be safely deduced from the foregoing data. That other things being equal, the less ash in coke, the less risk of sulphur or phosphorus in dangerous volumes in the resultant pig iron from the furnace. In many cases there is danger of injuring the physical condition of coke by the operation of washing the coal to reduce its slate. The washing of some coals improves the coke, in others it injures it.

In the discussion of this matter at the Hazleton meeting of the American Institute of Mining Engineers, in 1874: "Mr. Bell further remarked, as to the relative value of coke made from washed and unwashed coal, he was of the opinion that coke make from coal that did not require washing was superior to that made from washed coal." (Vol. III, page 182) Washing coal carries out in the operation valuable hydrogenous matter which aids in developing cell structure. The coke made from it would be more dense—in other words, that in many cases, the loss in calorific energy by the density in the coke from washed coal, would more than overtop the advantage of a reduction of ash, excepting cases where ash is excessive.

IV. Uniformity of Quality in Coke.

This is one of the essential requirements in view of the destructive action of carbonic acid gas on soft coke. The "black-ends," which are sometimes made in coking, are worse than useless in a blast furnace and if reckoned in the fuel charge must produce bad results. Hence, a carefully prepared coke, alike all through, is most desirable for regular work in blast furnaces This result can be best obtained from coal similar to the Connellsville, inheriting a liberal ratio of hydrogenous matter to assure full even heat and thorough coking in every part of the charge. This is one of the distinguishing features of Connellsville coke.

The Connellsville coal region is a separate prong of the Upper Coal measures resting along and near the western foot of Chestnut Ridge. It is two or three miles broad and sixty miles long. The coal bed is eight to ten feet thick, affording a bright, soft coal in thin sliced vertical plates. The "Pittsburg bed," as it is pursued east to Salisbury and Cumberland affords a coal lower in hydrogenous matter and yields a coke inferior to Connellsville. Westward the excess of pitchy matter in the coal leads to an inflated physical structure in coke.

It is thus evident that the Connellsville coal embraces in a larger degree than any other at present developed, the properties that make *excellent coke.* Its coal requires no washing and no special arrangements for coking. Its coke has grown in the confidence of furnace managers until it has now attained the distinguished position in America which the celebrated Durham coke enjoys in England.

Notes on the Mineral Deposits at Certain Localities on the Western Part of the Blue Ridge.

By Wm. M. Fontaine, Professor of Geology in the University of Virginia.

(Continued from Page 22)

2. Lower Gray Shales and Flags.—The lower portion of this member of the Primordial frequently contains bands of conglomerate, composed of quartz pebbles, often purplish in color, imbedded in a fine grained matrix of shale or slate. Their conglomerate portion, no doubt, was included by the brothers Rogers in the 150′ attributed to their Primal conglomerate. I would separate this portion from the basal conglomerate, because the conglomerate bands here are separated from the first named conglomerates by shales and slates, besides the conglomeratic parts are now very irreguer in thickness, being only occasionally found in a great mass of shale or slate. The pebbles also are simply quartz, attaining the maximum size of a musket bullet. Still these conglomerates are valuable guides, and denote that the observer is in the lower portion of the Primordial. They should not be confounded with a rock of somewhat similar character, sometimes seen in the fine grained argillaceous strata of the Huronian. These strata are sometimes filled with concretions of quartz, feldspar, &c., that, especially when the rock is weathered, cause it to resemble a conglomerate. The conglomeratic portion of the lower Primordial is sometimes much metamorphosed. The fine grained slates or shaly matrix in such cases is changed to a pale greenish glistening material like talc. In such cases, however, the included pebbles are unmistakably rounded by water action, and are always quartz, but the seeming conglomerate of the Huronian contains amygdules formed by concretionary action, as is shown by the concentric structure of the amygdules.—These latter, in such cases, sometimes show a shell of quartz surrounding a core of epidote, and other indications which prove that the rock is not a true conglomerate.

The lower gray shales and flags vary in character more than any other member of the Primordial. The predominant rocks are shales, that sometimes become slaty in firmness, and thinness of lamination, or various more silicious, flaggy rocks, that range from purely argillaceous shales through argillaceous sandstones, into massive and highly silicious quartzites. These latter have the character described above The predominent color is gray, but reddish, yellowish, or purplish and greenish colors sometimes occur.

Some of the grayish white, argillaceous strata, form a species of claystone that weathers to a sort of kaolin. For the sake of distinction, these may be called kaolin flags. This kind of rock is much more common in the member next under the Potsdam quartzite. The conglomerates occurring in the lower part of this member have been already described. With the exception of the conglomeratic portions of the quartzites, they are found as minor bands in the fine grained shales or slaty beds, the pebbles looking as if they had been scattered over a sea bottom of fine mud. This peculiar form of conglomerate, so characteristic of the lower portions of the Primordial, may, for the sake of distinction, be called shaly comglomerate. Sometimes a good deal of fine, partly decayed feldspar, occurs in the conglomeratic portions, especially those lowest down. In some cases the members of this group, both the more argillacaous shaly and slaty, and also the more finely conglomeratic portions, become charged with specular iron. The iron forms a thin envelope around the other constituents of the rock, or gives thin films in the planes of cleavage. This iron by its deep red color when bruised, causes the rock to appear to be richer than it really is. This diffused iron has, however, been the source of the richer deposits which, in the form of limonite, have been formed in disturbed portions of the Primordial beds. These beds charged with more or less specular iron, might be called specular ledges. Sometimes these ledges graduate into quite compact, and hard, reddish or brownish quartzites.

The general features of the quartzite members of this group have been already sufficiently discussed. Towards the southern portion of the belt, they attain great dimensions. This is especially true of the space between the southern border of Augusta county and Balcony Falls. At this latter place, a quartzite formation occurs about 150′ above the base of the Primordial, forming the Balcony rock. It lies in huge beds of a highly silicious character, and is not less than 250′ thick. Here the massive character of the beds has prevented the cracking and smashing, accompanied with the infiltration of silica, so often seen in the smaller beds of quartzite at this horizon in other places, otherwise the character is as given above for the lower quartzites, I have never seen any casts of Scolithus borings in these quartzites. The great quartzite at Balcony Falls disappears almost entirely in the northern portion of the belt, its place being taken by minor beds of quartzite, and by shales and flags. The subdivision of the Primordial beds now being described forms the lower portion of the Primal older slates of the brothers Rogers.

3. Red Shales and Flags.—This also is quite a variable group, and it changes its character very materially as we go south. In the northern portion of the belt, as far as Mt. Torrey, the greater portion of this group is composed of a fine grained, very thinly connected, and tender slate. When fresh this rock has a steel gray color, and pearly, or nacreous lustre, but on weathering, many portions become deep blood red in color, some of the lower and upper portions become yellow, but red is the predominant color from weathering. Some bands have small pebbles of the size of bird-shot graduating into sand Some of the red and yellow colors may be original, and not due to weathering. This cannot be decided as all the exposures seen were much weathered. This member, in its northern exposures, is often affected by faults, that cause it to extend over greater breadths than it could occupy in virtue of its thickness. Quartz veins occur in it, having the nature of fissure veins. Bands of this slate are impregnated with more or less specular iron, and this is the highest member of the Primordial that shows iron in the specular form. Some greenish, much indurated quartzite occurs in this member. This group to the south becomes more silicious, and the amount of red coloring matter diminished.

At Big Mary creek the slaty character is nearly lost, and the amount of red matter is much less. The strata are now chiefly rather silicious gray flags, and this character is maintained to Balcony Falls; there the rocks at this horizon are nearly all flaggy, and gray in color, some reddish and brownish beds however are found. This change to a more silicious nature is accompanied by a great increase in the accompanying quartzites. These strata everywhere, owing to their comparatively greater capacity for yielding to strains, have suffered much from contortions and minor faults.

4. Upper Gray Shales and Flags.—This group, as the name implies, is somewhat like No 2, but in it the conglomerates and specular ledges are wanting, and the amount of quartzite is usually much less, owing to the brittleness of the material of the beds, and the ease with which many of them yield to crushing, portions of the strata are often found crushed to loose fragments. In the fractured and crushed portions important deposits of limonite are sometimes found, that are evidently produced by the concentrating action of percolating waters. The reddish and brownish rocks found in No 2, are also wanting here. The predominant rocks are

shales and flags, usually all highly argillaceous, and when fresh, of a gray, or greenish gray color, but on weathering apt to assume a grayish white color. Towards the top quartzite ledges are interstratified with these, and cause a gradual passage into the Potsdam quartzite. In some places the amount of quartzite here is very large, and should properly be counted as a portion of the Potsdam member of the Primordial. Perhaps the predominant rock is a gray shale that resembles a hardened sandstone, and which graduates into a sandy shale, This rock often decays to a pure white clay, and, no doubt, furnishes the material for the pure potter's clay sometimes found immediately west of the Blue Ridge. These strata for the sake of distinction may be called kaolin shales or flags. These beds are decidedly less indurated than those of No 2., and none of these ever could be mistaken for Azoic beds. as is sometimes the case with the lower strata of No 2. This member in many localities to the south becomes much more silicious, and the number of interstratified quartzites increases. This is especially true of the region about Big Mary creek on the southern border of Augusta county.

5. Potsdam Quartzite.—The members of the Primordial below this, so far as observed by us, show no indications of the former existence of life. This portion of the formation, however, shows in some beds numerous casts of Scolithus borings, some of which are remarkably long, being visible for at least three feet. The brothers Rogers considered this member as identical with the Potsdam sandstone of New York. This portion of the Primordial is more constant in lithological character than the subdivisions that underlie it. Quartzite is always the predominant rock in it, the remaining portions being mostly composed of the kaolin shales and flags. To the south, and especially in the interval from Mt. Torrey to Buena Vista furnace, the quartzite is very massive and silicious, composing nearly all of the rock at this horizon. The material is more properly called a quartzite than a sandstone. The upper and lower portions are often flaggy, and cause a passage into the underlying shales and flags. So far as observed, these quartzites are never conglomeratic, and they are free from the infiltrations of silica, the diffused chlorite, and other characters that mark the lower quartzites. Near the junction of this member with number 4., the strata are often crushed, the crushed band holding important deposits of a dark limonite. The Quartzite members of this subdivision are sometimes broken up and crushed, forming a curious band of breccia, cemented by iron or manganese. Sometimes workable deposits of limonite are found in these disturbed portions.

6. Ferriferous Shales.—It might be a question whether these shales ought not rather to be counted with the Calciferous group. It is certain that there seems to be a gradual passage from the shales into the pure magnesian and silicious limestones, that corresponds to the Calciferous sandstones of New York. No fossils are found to settle the matter, and it seems best to draw the dividing line at the first marked change in in the lithological character of the strata. This change occurs with the lowest limestone beds, that usually occur interstatified with reddish and yellowish shales.

The Ferriferous Shale group is noteworthy for containing throughout it deposits of limonite which are often suited for the manufacture of a neutral iron. These deposits seem to be of concretionary origin, formed by the decay of the shales which contain the iron in a diffused form, probably, for the most part, as a carbonate, but sometimes as pyrite. These ores are consequently usually imbedded in clay. They assume the form of lenticular masses, usually built up of concretionary forms. These ores are unlike those found in and under the Potsdam sandstone, and not rarely are mingled with oxide of manganese or associated with it, forming ferromanganese. In the same shales, occurring under conditions similar to the iron, and formed in like manner, we find, not rarely, deposits of quite pure manganese oxide. This is always in the form of Psilomelane or hard manganese.

The lowest of the strata of this group have the character of kaolin shales and flags They graduate insensibly into the Potsdam quartzite member. In ascending they become purely argillaceous shales, generally of lead, or bluish gray color, when fresh. With these, moreover, occur strata yellowish reddish in color, the red often assuming a pinkish shade. Towards the top, ledges of pretty firm pure purplish shales and flags are found, that are sometimes of the nature of fine grained sandstone. The shales towards the top are often calcareous, and graduate into the impure limestone with which the Calciferous group may be assumed to begin.

We thus have in the Primordial formation, in the belt now being described, at least three horizons of iron ore. The lower strata contain specular iron ore usually of low grade, the middle portions, extending as far as the Potsdam quartzite, containing limonites, either impregnating definite strata, or filling what were once fissured and crushed bands. Hence all of these usually appear in massive or rocky outcrops. Finally in the ferriferous shales we have interrupted deposits of limonite, enclosed in clay, and often mixed with manganese.

Before giving the character of the ores at the different localities it will conduce to clearness to present a short account of the geological structure at the various points where these deposits occur. We begin in this description with Balcony Falls.

At Balcony Falls, the Primordial strata rest upon the western flank of the Azoic formations, with an undulating northwest dip. The more shaly members are much contorted being caught between the massive lower quartzites of the Balcony rock, and the Potsdam quartzite. For short distances they even show reverse dips, but soon recur to the N. W. dip. At the west entrance of the gorge the Potsdam quartzite dips steeply N. W., and to the west of this come the Ferriferous shales. This structure seems to prevail for a considerable distance to the northeast, as far as the southern border of Augusta county, and the vicinity of Cotopaxi furnace. Remnants of the lower strata are found in this interval at various points to the east of the most westerly outcrops of the Azoic beds. They seem to have been caught in folds in the Azoic strata, and to be thus preserved from erosion. As far as the southern border of Augusta county the Potsdam quartzite with N. W. dips forms the most western ridge of the Blue Ridge range. This is pressed up close to the Azoic ridges and is parallel to them. In this interval the Potsdam quartzite and the ferriferous shales do not pass to the east of the first or western ridge, hence east of this ridge, only the ores below this quartzite may be looked for.

Near Cotopaxi furnace, where the South river of the James emerges from the mountains, an important change in the geological structure takes place. Here the horse-shoe expansion of the Potsdam quartzite begins. The structure here is as follows: The most western ridge, composed of the Potsdam quartzite dipping N. W., has been carried down by a fault, and the ridge has been so much eroded as to present a low line of hills. A little further southeast, the first main ridge at the entrance of the gorge made by the South river of the James, is composed of a closed synclinal of the quartzite, overturned to the N. W. This is followed still farther eastward, or rather to the southeast, by an anticlinal that is not so fully closed as the synclinal, but like it is turned to the N.W. Thence to the S. E., towards the Azoic of the Blue Ridge, and extending across the plateau of the Big Levels, the strata dip on the whole towards the Azoic rocks of the Blue Ridge,

but very gently, and with undulations. By this structure the Potsdam quartzite is carried high up with a portion of the overlying ferriferous shales, the two groups forming the upper strata of this plateau. On account of this condition of things, we find some three miles up South river, the limonites and manganiferous ores of the ferriferous shales shown on the surface of the plateau, as seen at Newton's Mine Bank and in its vicinity. The geological structure on South river seems to be exceptional, for further to the northeast and for most of the distance around the plateau expansion, the northwestern margin of the elevated land is formed by the quartzite with northwestern dips. The channel of Back creek, in the vicinity of Mt. Torrey furnace, is in the shales and flags immediately underlying the quartzite, for here the Primordial strata are all overturned by being crushed against the Azoic rocks of the Blue Ridge.

From Mt. Torrey to Turk's gap the structure is different. The Potsdam quartzite no longer forms a connected ridge flanking the Azoic rocks on the west, or a broad upswollen mass, but is found in a series of disconnected, low and broken hills, lying usually some distance (from one to two miles) to the west of the main mountain mass. At Turk's gap the distance is less than a mile. The rock is so crushed and shattered in many places that it is difficult to make out the dip, but it seems to be to the northwest. The main mountain mass in this interval is usually composed of two closely placed ridges, the most westerly being formed of the lowest Primordial strata, and the most easterly of Huronian beds. Near Waynesboro we have only one ridge, and that is Huronian in composition.

In this portion of the belt the lowest shaly and slaty members of the Primordial are much altered, and as their materials were derived directly from the argillaceous schists of the Huronian upon which they rest, it is often difficult to distinguish the two formations. At Turk's gap, however, the lowest conglomerate of the Primordial may be seen resting on bluish gray, argillaceous schists of Huronian age, and containing large fragments of these schists.

After this preliminary account of the geology of the district we may turn to the nature of the ores occurring at the different localities.

An account will now be given of the mineral deposits found at the western foot of the mountain range, in the district extending from Turk's Gap to James river. This description will be limited to the minerals of economic importance.

Mineral Deposits along Western foot of Blue Ridge.

In this description the mineral deposits will be taken up in the order of their occurrence, beginning at the northeast and proceeding southwest.

Crimora Manganese Deposits.—The manganese at Crimora occurs in the clays formed by the decomposition of the ferriferous shales of the Potsdam. Here these shales are thrown into a synclinal, and lie between the low anticlinal quartzite ridge of this section, and the most easterly outcrops of this rock that forms the western flank of Turk's ridge. The present workings are by shafts on a small stream, and the ore is obtained some 60′ beneath the surface, having been followed to that depth from the surface. A little farther east the older workings are found. These were made in the form of open pits on the surface. Most of the manganese obtained in these pits was evidently "float," as the lumps were mixed with transported clay and boulders. In the present workings the ore is obtained in its original position. It occurs imbedded in the clay in the form of nodules, large masses, and irregular sheets. The latter are formed by the union of masses that lie in a pretty uniform direction. All of this is evidently concretionary in origin, and was concentrated by concretionary action from the manganese that was originally diffused, probably in the form of a carbonate, in the ferriferous shales It is evidently now forming. Many facts go to show that such was and is its origin. The masses of ore all have a concretionary structure, and often enclose portions of clay. They are enclosed in clay which folds around them and penetrates between them. Mr. Donald informs me that the manganese is most abundant in clay of a red color, and one that contains much water. This is what we would expect if the ore is collected and concentrated by concretionary action, for the water must have free circulation in order to accumulate any large amount of ore. Many of the clays associated with the manganese in the ferriferous shale horizon are colored brown by the mixture of diffused manganese with iron. The concentration of the manganese into masses would leave the iron predominant and the clay red. In the other localities I have seen the process of concentration of the manganese in these clays now going on, crusts and nodules of manganese being formed. The amount of manganese at these workings is unusually large. I think that the geological occurrence, in part at least, accounts for this. The ore occurs in a synclinal of the Potsdam quartzite, and most of it is found just S. E. of or behind the barrier of the low anticlinal ridge of quartzites. The synclinal basin has all of its manganiferous waters drained down against this ridge, and a consequent accumulation of the ore against it. The Crimora mines have yielded a large amount of ore of fine quality, which for some time has been successfully worked by Mr. Donald. The ore is hard manganese, or Psilomelane. Very rarely we find some little Pyrolusite forming thin veins and nests in the lumps of Psilomelane. The ore has been proved to the depth of 60′ and over a considerable area.

Iron Ores at Crimora.—Very little attention has been paid to the iron ores at this place as the workings are carried on solely for manganese. As the shales that contain this manganese are those that so generally afford large deposits of iron ore along the western foot of the Blue Ridge, we might expect to find this ore here also. In fact at least one very promising deposit has been disclosed by the open cuts made in the old workings. The ore here appears to be in the form of a ledge, and it is quite well defined. Only a small opening has been made on it which, however, shows the ore to be continuous throughout its extent. As thus disclosed, the exposed portion is 20′ long, 8′ deep, and 8′–10′ wide. The material is a pretty massive one, and has a dark color, due to the presence of a considerable amount of manganese that is intimately mixed with the iron, causing it to form a ferromanganese ore. It deserves attention, as the amount of manganese may be sufficient, with but little admixture of additional manganese, to make spiegeleisen. Good indications of workable deposits of iron ore are reported to exist on Mr. Patrick's land, 1 mile S. W. of the manganese deposits. I did not visit this locality.

Iron Ore of Mike Knob.—Mike knob is a ridge composed of kaolin flags and quartzite. It lies about 1¼ miles N. E. of Bell knob and the C. & O. Ry., being a little east of the prolongation of the strike of the quartzite in Bell knob. It is, I think, composed of the upper gray shales and flags of No. 4, near their passage into the Potsdam quartzite. The ridge is a low one, and the ore occurs near its top in what appears to have been a fracture of the strata. The material is found quite pure and massive in some portions of the vein, as we may call the deposit, filling what was the open part of the crevice. It occurs also as a cementing material binding together the shattered wall-rock, or impregnating the walls. The strike of the vein, as made out from the opening on it, is N. 15° W. The more solid ore varies from 4″–8′ in width,

and in one place swells out to the width of 14′. The width is very variable and fluctuates rapidly. Most of the material has a dark chestnut brown color, some being almost black, with a rather resinous lustre. It is a limonite, and has the physical character of the ore that very commonly occurs to the south-west at about this horizon, and which is known as cold short ore. This ore was examined for phosphorus and sulphur, the only impurities that are likely to occur in the ore of the best grade. The best ore was chosen for analysis. It showed 56.99 per cent of metallic iron, 0.972 per cent of phosphorus, and a trace of sulphur. The analysis of this and the other ores, subsequently to be described, was made in the Laboratory of Chemistry at the University, by Messrs. Allen, Sloan, Echols and Musgrove, members of the class of 1881-2. In these analyses only such substances as are likely to affect the value of the ore were sought for, and complete analyses were not attempted. In all cases the phosphorus is determined as $P_2 O_5$.

The Mike knob ore has been worked to a considerable extent, and at one time the Powhatan iron company shipped the ore to their Westham furnace situated on James river, 5 miles above Richmond.

About 500 yards to the east of Mike knob, and apparently still in the flags of No. 4, we find another deposit of limonite, also occupying a crevice in the flags and impregnating them. It is not so dark as the ore of Mike knob. The deposit is found on the south end of Ramsay mountain, which is a low ridge in the flags and shales. It occurs on the land of the Hanger brothers. It is exposed by a very small opening made by Mr. B. Jordan, which perhaps does not disclose the true character of the deposit. It does not show so much iron as is seen on Mike knob, for only 1′-2′ of ore is visible. It occurs like the deposit of Mike knob, and those of many other localities, in the rocks of No. 4, filling a crushed and fissured band in these strata. The iron was clearly introduced in solution in the waters percolating through the fissure.

Rockfish Gap Iron Ore Deposits.–Rockfish Gap is the name of a large body of land owned by Messrs. Echols, Bell & Catlett. It extends some distance north and south, chiefly south, of the C. & O. Ry. at Rockfish Gap tunnel. The iron on this property occurs in two ways. In one, the ore which is in the specular form, occurs, impregnating certain of the shales and shaly conglomerate ledges of Nos. 2 and 3. This material is the type of a ferruginous rock that occurs all along the Blue Ridge, in the strata of Nos. 2 and 3, with varying richness. This is what I have spoken of from time to time, as the specular ledges. The mass of the material is a shaly matter composed sometimes of decayed feldspathic material mixed with argillaceous material, and sometimes wholly composed of argillaceous matter Sandy particles, and often small pebbles, occur sprinkled throughout the finer matter. The iron is in the form of thin films, coating the argillaceous substance. In some cases the amount of iron is sufficient to form an ore capable of being smelted in the furnace, when mixed with other ores. There are at Rockfish Gap, on the railroad, several ledges impregnated with iron. Most of them are of a sandy nature, but at least two are impregnations of fine grained shale, one occurring in the red shales, and the other in the gray shales between the two bands of red shale. An analysis of the best ore obtained from these deposits, made to determine the amount of iron and silica, showed 17 per cent of metallic iron, and 37 per cent of silica. The other form in which iron ore occurs here is limonite, impregnating certain ledges, or forming a cement binding together cracked and crushed portions of the strata. This ore promises to be more abundant and richer than the specular iron. In some cases the exterior of some of the specular ledges is changed to limonite, which is concentrated into nodular particles, but most of the limonite deposits have their iron deposited from percolating waters. One of the sandy ledges, not far below the base of the lower band of red shales, has a good deal of good ore in the form of nodular impregnations and crusts in the rock. A little manganese is sometimes associated with these infiltrated ores. Counting the specular ledges and limonite impregnations there at least 11 or 12 bands in which ore is found. Among these are included no doubt the deposits of Mike knob, and of the Hanger property, for these traced S. W., would pass through this estate. It is a noteworthy fact that the specular iron is mostly to be found in the lowest Primordial strata. Limonite predominates in the upper strata, and near Waynesboro no specular iron is found above the basal strata of No. 4. The development of some of the infiltrated limonite was no doubt connected with the eruption of the trap dykes.

Ochres of Samuel Steele.—On the land of Mr. Samuel Steele, a little N. W. of Waynesboro, and 2½ miles distant from that town, there is an interesting, and, in my opinion, valuable deposit of ochre of several kinds. This occurs of course within the Valley limestone. A heavy dyke of trap penetrates the limestone on Mr. Steele's place, running in a N. W. and S. E. direction, and passing a considerable distance within the Valley. A band of yellowish clay runs though Mr. Steele's land in a N. E. and S. W. direction following the strike of the strata as it seems, and forming apparently one of the more decomposable argillaceous layers interstratified with the limestone. The limestone next to this, is, in places, very cherty and seems to have been disturbed. The clay is associated with a peculiar yellowish, to dark brown rock, that graduates from a nearly pure compact silica to an umber or ochre. Near Mr. Steele's house and for a short distance to the S W., the rock is very siliceous and is accompanied by a dark to black wad of impalpably fine texture. This material seems to be composed of very fine manganese powder, clay and iron, with some graphite. The manganese and graphite give its character to the rock. Sometimes it is purplish in spots, but the most of the mass is nearly black, or a very dark brown. It has a soapy or greasy feel, and clings most tenaciously to any object touched by it. The deposit of wad varies from 10′-30′ in thickness, and in length has been proved for several hundred yards, while in depth, the excavations show that it descends more than 30′. There is clearly an immense supply of it. Frequently lumps of manganese are found in it, sometimes as large as one's fist. At one of the openings a seam, said to be 18″ thick, of a beautifully white clay was cut. This is the most tenacious and plastic clay that I have ever seen. It may be chewed between the teeth behaving like flour. If there should be any body of this clay, it will prove valuable to mix with the clays found at Porcelain, to aid their plasticity. The wad has been tried as a fire proof paint on boilers, and is reported to act finely It mixes well with oil, and has so much "body," that little white lead is needed to mix with it. From all that I could see I consider this to be a valuable material, and I am surprised that it has not been utilized.

A little to the N E. of the deposit of wad, and apparently in the prolongation of it, we find no longer the wad, but the silicious rock has become argillaceous, and decayed to a handsome ochre. This varies from a rich yellow to a dark brown. The dark brown ochre makes up much the larger part of the deposit. There are two beds of it lying in clay. The upper one shows a thickness of about 2′, and is separated from the lower one which is 3′-4′ thick, by 3′ of clay. Some of this ochre is firm and looks like a rock, but it may be easily crushed. The yellow ochre occurs replacing a portion of the brown. Both of these appear to be suited for

paint. This deposit of ochre appears to continue some distance to the N. E. and S. W. I was informed by Mr. W. B. Alexander that at Red Bank, about 7 miles N. E. of Waynesboro, and on a line bearing 40° E. of N. from Mr. Steele's place, similar brown and yellow ochres occur. Fauber's umber mine occurs some 4 miles to the S. W., in the prolongation of this line of deposits, and is, I think, the same material. There is little doubt that a series of ochres of various colors and excellent quality, could be selected along the outcrops of this material. All of the ores and ochres thus far described, lie within a short distance of the C. & O. Ry., and the S. V. RR.

A. G. Palmer's Iron Ore, occurs 2.5 miles S. W. of Waynesboro, and less than a mile from the S. V. RR. There are several deposits of ore on Mr. Palmer's land. The main deposit occurs in the upper gray shales and flags of No. 4, close under the Potsdam quartzite. It appears to form a regular bed in these rocks. It has been opened, and formerly some ore was taken from it to supply an old furnace operated by Major Dowell. The ore occurs partly as clean solid ore in a ledge, and partly impregnating the wall rock, the latter forming a lean material. It has as a wall ferruginous shale, and much of the breast exposed in the opening, is formed of alternations of ore and ferruginous shale. The shale is mostly decomposed to clay. The entire width of the breast showing ore is 12′. In this a band of solid ore free from shaly matter and rock is found 5′ wide Besides this there are several bands of good ore 6″–8″ wide, interstratified with the ferruginous shales. The deposit will yield a large amount of good ore, and it is practically untouched. From the physical character of the material, much of it seems to be a pure ore of high grade.

About 200 yards to the west of this deposit, the Potsdam quartzite shows itself in the crushed condition commonly exhibited by it in this region. It contains in several places, apparently where it has been fissured and crushed, pockets of ore. Some of these have been opened by small pits, and show a beautiful bright brown ore, with a very open and cellular structure, apparently of great purity. None of the pits indicate that any one of the deposits is of great extent, but if we may judge from the amount of loose ore on the surface at points not opened, the number of these pockets must be considerable, and the amount of ore that may be obtained from them is no doubt large. The color and general appearance of these ores, as well as of the principal deposit, differ in a marked manner from the ore of Mike knob. The dark color and waxy lustre is not found here. The furnace which was supplied with ore from the main bank, according to the information given me, was built at the crossing over the South river, 2 miles S. W. of Waynesboro, by a man named Moore, probably about the year 1780. Moore leased it to Major Dowell who operated it for some time, and obtained ore from Palmer's bank. The furnace was succeeded by a forge which was known as the Clay-bank forge, or Clay forge. To judge from the float ore there must be another line of ore deposits a little to the east of the main bank, for there is a large amount of good ore strewed about here. An old opening is found on Capt. Henry's land, which lies next to Mr. Palmer's at this point, and it is probably made on this concealed vein, as we may call it. The opening now in question is very old, and has not been cleaned out, so that I could not see the ledge or vein. It was made to obtain ore for the old Dowell furnace. To judge from its size, a considerable amount of material was taken out from it. The appearances indicate that the ore occurs in the flags of No. 4, much in the same manner as Palmer's main ore bank. Some 200–300 yards still farther east, we find a deposit of dark ore, just like that of Mike knob so far as physical characters go. This ore seems also to occur in the strata of No. 4, but the exposures are so poor that I could not be positive on this point. The enclosing strata are gray shales and flags. The opening made on this deposit is very old, and hence does not fully expose the extent of it. It was made by Major Dowell to obtain ore for his furnace. This opening still shows several feet of a compact dark ore free from earthy impurities. The loose ore may be traced for some distance on the surface, and the size of the masses indicates a deposit of considerable thickness. This ore is called in this vicinity, the cold short ore, and it has the physical character of that which very commonly occurs at about this horizon. Very little attention has been paid to the iron in this vicinity. Most, if not all of the openings date back to the time of Major Dowell, and far into the past. I have no doubt that careful search would disclose other deposits, and would show a large amount of ore in this immediate vicinity. The dark ore last mentioned occurs on Wm. Gallaher's land. Two or three hundred yards farther east there is an exposure of a specular conglomerate, with some lean limonite impregnating the rock. There is also near this point some lean argillaceous red hematite, lying between ledges of quartzite. Neither of these is at this point very promising. Gallaher's dark ore is the farthest from the S. V. RR., and this is within two miles of it. The geological section across the Primordial through Palmer's place is in general the same as that at Waynesboro. The Potsdam quartzite is so broken down that its dips and strikes were not made out. All the underlying beds occur in order but overturned. The upper gray shales and flags occupy a wide space. The red and nacreous gray slates and shales show a heavy mass, fully 600′ thick, forming the high narrow-backed ridge called Stony mountain. This ridge forms one of the hammer-heads that are connected by transverse ridges, corresponding to the handle of the hammer, with the Azoic portion of the Blue Ridge.

Moses Alexander's Ore.—The deposit of iron ore on the land of Mr. Moses Alexander occurs about 5 miles from Waynesboro. The Potsdam quartzite, that at Palmer's was almost entirely broken down, here forms a pretty bold detached ridge just east of Mr. Alexander's house. Behind this ridge and in the strata of No. 4, the deposit now in question occurs. It has the form of a ledge, and is evidently one of the strata impregnated with iron. The exposure made of it is very slight, so that perhaps the true character and extent is not shown. Hardly anything has been done except to clear off the outcrop. The ledge is some 4′ wide, and shows some rich ore, although the greater part is rather lean. This deposit seems to occur some distance under the Potsdam quartzite, and toward the base of No. 4. Not far below the Potsdam quartzite, and about 300 yards west of this iron ore, on the land of Joshua Robertson, a deposit of manganese occurs. This is Psilomelane, which forms the only ore of manganese found in the Primordial of this section of country. The mineral occurs in a cracked and crushed band of the upper gray shales and flags. It is now so much filled up that I could not see the precise mode of occurrence. It appears, however, to have filled an open fissure, and impregnated the walls which are kaolin flags. This is an unusual occurrence for the ore of manganese in this region, for it is usually found in the ferriferous shales. The origin is clearly similar to that of the iron ore occupying a similar geological position, viz: deposition from solution in water in disturbed belts. The opening was made by Mr. Sibert in 1857. He is reported to have obtained perhaps 100 tons from this deposit. I was informed that this ore was not exhausted, but that the work here was abandoned because Mr. Sibert found a deposit that was more easily worked.

Traces of manganese are found at other points between this place and Waynesboro, but none of them had at the time

of my visit given evidence of any considerable deposit. On the land of Mr. Pat. Childress, a little N. E. of Mr. Palmer's place, and almost immediately on the line of the S. V. RR., a bed of brown manganiferous clay occurs, interbeded with yellow clay. The former contains nodules of small size of manganese.

On the land of Moses Alexander there are found places in the Potsdam quartzite, that are crushed into a sort of breccia and cemented by manganese deposited from the percolating waters. Some indications occur also on the same land in the ferriferous shales on Back creek, in front of the Potsdam quartzite. It is possible that workable amounts of the ore may be found at both localities.

Kaolin at Porcelain.—"Porcelain" is a locality so named from the erection of these works for the utilization of the clay found at that locality. It is situated near Sherando station of S.V. RR., about 7 miles S. W. of Waynesboro, in the alluvial land between Back creek and the South river of the Shenandoah, and close to this latter stream. It is within one mile of the S. V. RR. The surface is composed of sand, gravel, and cobble stones. These are underlaid by a yellowish clay which rests on a bed of white clay, which appears to be true kaolin. The deposit of kaolin lies at a pretty uniform level, being deepest under the slight elevation found here. It appears to have been deposited in a lake, and to form a pretty uniform sheet under a considerable area. It is claimed, and I think justly, that the clay has been proven to exist under at least 25 acres of land. The clay has been tested by open cuts, shafts and borings. In the bottoms where it is least deeply buried, it is found about 6′ below the surface, and 20′ would reach it anywhere. The clay is variable in thickness. A thickness of 30′ is said to have been found. There is no doubt that the supply is very large. The best clay is a very fine, quite plastic material, very free from silica. The colors are pale yellowish, pale bluish, and pure white. At the time of my visit the excavations were full of water, and hence my examinations were limited to the raw material taken out and to the products manufactured from it. During and immediately after the war attempts were made to manufacture pottery, drainage tiles, and fire-brick from this clay. The following is the history of the operations as told to me by reliable persons acquainted with them. The first attempts to utilize the clay were made about 1863, by the formation of a company and the erection of very imperfect works. This company made various articles of coarse pottery by mixing a blue clay found in the vicinity with white clay. The articles were noted for their great toughness and strength. This ware was of course dark from the admixture of the blue clay. Some of the cups and saucers, however, seem to have had but little admixture of other material with the white clay, for they are of a cream color. I could not learn why they preferred to mix other clay with the kaolin, but infer that the unskilled workmen employed by the company could not deal with anything but coarse ware. Perhaps the pure white clay was disposed to crack. They attempted to make white ware but failed in the glaze. It must be remembered that this was during the war, when every attempt of this sort had to meet with unusual difficulties. About 1867 this company stopped from the want of skilled workmen. The property was sold to an English company. This latter company began operations in 1871–2, under the management as is said, of men not acquainted practically with the business, and who did not attend to the finances of the company. They spent a good deal of time and money in making preparations. A large amount of machinery was finally put up, and among the rest a fine engine. Two cupola furnaces were erected and other preparations made for manufacturing on a large scale. During these preparations a fire destroyed everything, but this did not deter them. A good deal, if not all of this machinery is still present, but is of course much out of repair. Finally the company collapsed from bad management. This took place before they had made an attempt to manufacture any pottery. From all that I could learn it seems clear that no fair trial of the capacity of the clay has been made. This company made some fire-brick and drainage tiles. The tiles seem to be very good. The fire-brick is of two kinds. Some of the clay appears to have more silica than the average, and the brick made from this seems to be hard and of good quality. Most of the clay, however, has but little free silica, and the bricks from this are too soft. This defect could be easily remedied, for an abundance of fine sand may be obtained not far off, and by mixing this in proper proportions with the clay, a good firm brick could be made. So far as the physical character of the clay is concerned, I see no reason why ware equal to the best made from the New Jersey clays, cannot be made from it. The location is good, clays, ochres, and sands abound in this region, and the conditions seem favorable for the carrying on of varied manufactures. The silicious kaolin of Nelson and Amherst is not far off, and might possibly be utilized in connection with these clays, especially in the fire-brick.

The fire-brick burns beautifully white. An analysis of it shows of potash, K_2O – .66; of soda 1.95, or only 2.61 per cent of alkalies; .48 per cent of metallic iron is present. The sand and clay shows of soda, Na_2O, 1.53; of potash, K_2O, very little, and .48 per cent of metallic iron.

About two miles from this locality, near the burnt mill, on the Howardsville road, a deposit of very pure white sand is said to exist. Some of it was sent some years ago, to the University of Virginia, where it attracted attention by its great whiteness and purity. The deposit was not visible when I passed by the locality, as it is buried under the coarse surface sand that abounds there. It deserves attention, for it may render possible the manufacture of glass along with pottery at Porcelain. In this connection I would call attention to the source of this sand. Some portions of the Potsdam quartzites, as is shown at Bell knob and elsewhere, is a friable silicious material that easily crumbles into a loose sand. It is this rock that yields the pure sand found at several localities. Where I have seen the rock in place, it has a pale buff color, and is not pure enough for the manufacture of glass, but judging from the boulders of it found near Greenville, I am sure that a little search would disclose the rock, in place, of sufficient purity to make the best of glass.

(To be continued.)

The Medina Sandstone, one of the rocks of formation No. IV of the Virginia survey, is extensively quarried, for paving and building purposes, in western New York; the stone presenting various shades of color from a dark gray to a light peach-blow.—These same sandstones are very abundant in Virginia and West Virginia, in most of the mountain ranges between the Blue Ridge and the Great Carboniferous escarpment, convenient to the lines of many of our railways, and we would suggest that an effort be made, by the concurrent action of the owners of quarries favorably located and the managers of our railways, to bring these durable and everyway excellent building and paving stones into use. They are very accessible to the Chesapeake & Ohio in the North and Mill mountains, to the Valley railroad in the Massanutton and North mountains, to the Baltimore & Ohio main line all along the Potomac from Little North mountain to the Alleghany front ridge, to the Shenandoah Valley road in the Massanutton, Purgatory, Tinker and other mountain ranges, and to the Norfolk & Western in the ranges west of The Valley, especially those cut by its recently opened New River division.

Coal Mining on Great Kanawha River, W. Va.—We take the following coal mining notes concerning Kanawha, W. Va , mines, from the Pittsburg, Pa., "Telegraph" of March 31st.

The Coalburg mines continue to run quite steadily every day, shipping both by rail and river; the greater part of the loading is now done on the river. The output is about 7,000 bush. daily. These openings are into the splint coal, which averages about 3 feet 8 inches. The miners receive 3½ cents per bushel for mining. About 175 men are in the employ of the company. The Buck mine above here is also running, employing between 30 and 40 men. Across the river, at North Coalburg, the Straughan mine is running steadily, employing about 100 men, and shipping by river. The Peabody Coal Co., above, are opening their mine in the lower vein. Their new mine in upper vein is idle at present. The two new mines up Cabin Creek are about ready to commence shipping, and will do so as soon as the Cabin Creek RR. Co. complete their tipple at the river.

This has been quite a brisk week at the Malden mines, all of them running full time. Since the meeting of the miners of the Campbell's Creek Coal Co. and the Dana Bros. mine, last Saturday, at which it was decided to accept the half cent reduction for the spring run, the men have got down to work again and the usual large output of these mines is coming. The mining price will now be 2½ cents per bushel in these three mines. A number of single men have been drawn out of all these mines so as to give the other miners all they can do. All three of Lovell's mines are running steadily. Three cents per bushel is still paid here, but rumor says a reduction will take place the 1st of the month. They received another of the Lechner coal cutting machines this week for their No. 3 mine, making now six in all, three of which are run through the day and three at night.

An English company, under the title of the Great Kanawha Colliery Co., Limited, under the general management of Mr. S. G. Phillips, is making arrangements to open up and operate one of the largest works along the Kanawha river at this point, Carbon Hill, about 4 miles above Coal Valley. The openings and works are under the general supervision of Mr. William Tamplin, who has about 100 men at work opening the mines and preparing to build the tramroad. They will build 50 of the improved Coppee coke ovens at once. They talk of bringing the works up to a capacity of 1,000 tons daily for shipment and coke works. They have 3,000 acres of land. The company is composed of some of the stockholders who are interested in the Hawks Nest and Ansted works, W. Va., and the large furnace at Goshen, Va. If the push and enterprise displayed at the above named points is any indication of what they will do, this certainly will become what they claim, one of the largest works along the Kanawha.

The Kanawha Cannel Coal Co. have now in full operation, under the general supervision of Mr. H. W. Reynolds, one of the finest coal mines along the Kanawha river. The mine is five miles back from the river on the Paint Creek Railroad. It is opened into a vein of fine cannel coal, running from 3 to 5 feet in thickness, on top of which is 30 inches of good bituminous coal. They have been making improvements as rapidly as possible and extending the works. About 70 men are now employed. The miners receive 3 cents per bushel for the cannel coal, which they mine four days in the week, and 2 cents per bushel for taking down the top bituminous coal two days. The coal is all run to the river and loaded in barges. It commands a good market below, guaranteeing a steady run. They have purchased the Ella Layman to do their towing. The Crown Hill mine at this point, in charge of Mr. Brewer Smith, has been making a good and steady run for some time, averaging about 7,000 bushels daily. This opening is made into the fine splint coal vein of this region. About 125 men are employed. Three and a half cents per bushel is paid for mining. Shipments by both rail and river.

The large mines of the Winifrede Co., located back five miles from the river, upon Fields creek, are now under the general supervision of Mr. G. C. Hersett, formerly of the Heckla Coke Works, near Mt. Pleasant, Pa. About 150 men are now employed. They are putting out about 7,000 bushels of coal daily, which is run down the Winifrede Railroad, a standard gauge road, to their fine large tipple at the river, where it is loaded in barges for the lower river trade. The mines have been well opened. The company are preparing to do a large business this season. Mr. James Morgan, formerly of Tioga county, Pa., has charge of the mining departments. The coal averages 4 feet 10 inches in thickness, through which a slate from 4 to 6 inches thick is found 8 inches from the bottom. Three cents per bushel is paid for screened coal. Some time has been lost lately by the crippling of their locomotive. A new one is being built and will soon be on the road. This company is arranging to build boats, and will this spring load the first coal that ever went out of the Kanawha river for New Orleans Mr. Graham Macfarlane, the former superintendent of the Winifrede works, is now busily engaged opening a new mine on the opposite side of the river. He has opened into the Lewiston vein, and is said to have struck 4 feet of fine coal. Incline, tipples, etc., will be built at once and shipments made by the river.

The Coke Industry in West Virginia in 1880 appears in the tables of the Compendium of the 10th census as follows; the figures for the United States are added:

		W. Va	U. S.
Establishments		12	149
Capital		$330,000	$5,545,058
Hands employed	Males over 16	159	3,068
	Youths	4	71
	Females under 15	....	3
Paid for wages during year		$48,942	$1,198,654
Tons of coal coked		148,480	4,360,110
Value " "		$135,944	$2,761,657
Value of other materials used		$3,020	$233,784
Total value of all materials used		$138,964	$2,995,441
Tons of coke made		95,720	2,752,475
Value " "		$216,528	$5,359,489

The above makes the value of the coal used for coke a little over 91 cents a ton, and that of the coke made a little over $2.25 a ton.

West Virginia ranked 3rd among the 8 states that made coke in 1880, only Pa. and Ohio outranking her. She was 2nd in capital invested in this business, 2nd in number of hands employed, 3rd in amount paid in wages, 4th in tons of coal coked and in value of coal used, 5th in value of other materials used, 3rd in tons of coke made, 3rd in the value of coke, and 3rd in number of establishments.—The preface to the Compendium states that these statistics were gathered by Mr. J. D. Weeks of Pittsburg, Pa.

Now (1883) West Virginia undoubtedly holds the second place in this important industry.

The Virginias.

No. 40. Vol. IV.—No. 4.

Staunton, Va., April, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

The spelling of derivative words in *The Virginias* is in accordance with a rule that has been deliberately adopted and that will be followed hereafter.

The Index for 1882 vol. is unavoidably delayed. It will be sent out as soon as completed.

The Cincinnati Iron Market.—E. L. Harper & Co., under date of April 23rd, 1883, report to *The Virginias* as follows: "The general orders for *foundry pig iron* are probably up to the usual requirements at this season of the year. The demand for *mill iron* will be necessarily limited until there is an adjustment of the wages scale. There are hopeful indications that the manufacturers association and the amalgamated association will agree upon a scale which will avert the calamity of a strike. Of the, say 709 blast furnaces in the country, 334, or nearly one-half are now out of blast, and while several new ones which will produce very liberally, will light their fires at an early day, more in number will blow out, so that the aggregate production will in all likelihood be steadily curtailed during the summer, which will eventuate in bringing supply and demand into closer harmony, and an improvement in prices." They quote charcoal foundry pig at $23 to $25, and coke at $20 to $21.50; gray forge $19 to $20.50, and mallable car-wheel at $25.50 to $29.50, according to grade and origin, at 4 months.

Rogers, Brown & Co. write us, under date of April 23, "that the markets throughout the North and West are dull and unpromising. There is a good deal of pressure to sell and but a slight demand. This seems to indicate over production, but if such an evil exists, furnace owners are taking prompt measures to correct it. Latest reports show that there are more furnaces now out of blast than at any time since the depression ending in 1879. From Jan. 1 to April 1, this year, not less than 55 furnaces blew out, and there are now nearly as many furnaces idle in the U. S. as are making iron. The check in production from present indications will be still more decided the next quarter, as prices are at a point where many furnaces now making iron cannot continue without loss. Unless, therefore, the consuming capacity of the country is very greatly reduced, the evil of overproduction, if any exists, will speedily be cured.

The range of prices is about 50 cts. per ton lower than a month ago. Forge irons are temporarily neglected and dull, in anticipation of a general strike among the rolling mills June 1. For foundry irons there is a limited steady demand for current consumption. Car-wheel metal has been in better demand, but no improvement in prices is noted."

"Victoria furnace, at Goshen, Va., just beginning blast, starts off with about 6,000 tons of orders entered, and with most flattering prospects in all directions."

They quote the following cash prices: Hot-blast foundry $19 to $25, forge $18.50 to $20; car-wheel and malleable $25 to $33, according to fuel, grade and district whence derived.

The Coke Question—raised in a friendly controversy between *The Virginias* and "The Keystone Courier" upon the comparative merits of Connellsville, Pa., and New River, W. Va. cokes as blast furnace fuels—is far from being settled by the pamphlet entitled: "Furnace fuels. Connellsville coke superior. Why it is better than the Cokes of West Virginia.—The Four Prime Requisites of Good Coke explained. By John Fulton, Mining Engineer," (the full text of which was published on page 40 of the March number of *The Virginias*), as the vigorous and decided comments of Prof. Fred. P. Dewey, Curator of Metallurgy in the National Museum, Washington, D. C., that appears on page 51 of this number. We shall look with interest for Engineer Fulton's reply to the square issue taken with him by Metallurgist Dewey. Our columns are open for a full discussion of this important question, one that has a practical bearing on the cost of iron manufacturing in a large portion of the United States,—for the competing blast furnace fuels of the near future, over a widely extended and large producing iron manufacturing region, will be West Virginia and Western Pennsylvania cokes.

In order to discuss fairly the merits of the cokes in question it is absolutely essential that the properties of each one of them should be determined by the same physicist and by the same methods; that done comparisons are in order, and not before. To this end, *The Virginias* has made arrangements with a thoroughly competent chemist and physicist, one having the best of laboratory appliances for this purpose at his command, to fully and thoroughly determine the chemical and physical properties of the principal cokes not only of West Virginia and Pennsylvania, but also of the other coke making states. We are perfectly willing that our cokes should stand upon their relative merits, and what those merits are we are determined to have authoritatively ascertained.

To this date we have in hand, for testing, samples of the following cokes:

1st. From Pennsylvania, kindly furnished by John G. Fulton, E. M., and selected by Mr. John McFadyen from the coke works of; (1) Cambria Iron Co., (2) John F. Dravo, (3) H. C. Frick, and (4) J. M. Schoonmaker & Co., "typical specimens of the products of Connellsville coke," says Mr. Fulton; and (5) from Broad-ford coke delivered at Crozer furnace, Roanoke, Va.

2nd. From West Virginia: from coke works of (1) Quinnimont furnace, (2) Fayette Coal & Coke Co., (3) Fire Creek Coal & Coke Co., (4) Longdale Iron Co., all using New River or Lower measures coal; and from (5) St. Claire, and (6) Eagle coke works, using the Great Kanawha or Middle measures coal.

3rd. From other states, samples from Colorado and Tennessee.—This list will be continued as the typical cokes are collected.

The Flat-top New River Coal-field of Virginia and West Virginia is at this time one of the topics of absorbing interest in these states, for it has just been reached by a thoroughly well constructed and equiped branch, 75 miles long, of the Norfolk & Western Ry, and its high grade New River, steam, domestic and coking coals are now being used by the Shenandoah Valley and Norfolk & Western railways and will soon appear in the markets, as will also the coke made from them. The first through train passed over this road about the middle of March, but the practical opening was about the middle of April, when the regular shipment of from 10 to 20 car-loads (40,000 lbs.) of coal a day began.

On the 15th instant,—with president Kimball, engineers Coe and Graham, and freight agent Hatch, officials of the Shenandoah Valley and Norfolk & Western railways, mining engineer Austin of Roanoke and Mr. Everett Gray of the banking house of Vivian Gray & Co. of London, England, and under the guidance of the efficient and urbane mining engineer and superintendent of the South-west Virginia Improvement Company, Mr. W. A. Lathrop,—we had the pleasure of inspecting the coal mines, tramways, coke ovens, coal pocket, mining village, etc., of the S. W. Va. I. Co., at Pocahontas. We found that about 9,000 ft. of gangway had been driven in the "big" or "Nelson" coal bed (No. 3 of the Flat-top section), in which tramways had been laid, a coal pocket of 2,500 tons capacity was completed and a tramway laid to it, a large number of mine cars, of a superior character, from the Tredegar Company, Richmond, Va., were on hand, a number of coke ovens had been completed and a large force of brick layers were at work on others, etc., etc. A large number of miners were at work and more were arriving daily. All the accessories for coal mining and coking on a large scale were nearly completed, and so also were the sidings, turn-tables, etc., of the railway; consequently the shipment of large quantities of coal and coke by the S. W. Va. Improvement Co. will begin early in May.

The Bluestone Flat-top Coal Co., that owns 50,000 of coal and timber lands lying to the northeast of and adjoining the lands of the S. W. Va. I. Co., has recently completed detailed surveys of its lands and opened and fully proved the New River or Lower Measures (No. XII) coal beds on them, finding those of the Pocahontas section of full thickness and other thick beds higher up in the section.—This company proposes to at once develop its coal beds by mining and leasing, the Norfolk & Western Ry. having agreed to construct a branch line down Bluestone river, from Laurel-mouth, to good mining points on Mill, Simmons, Bell and Flipping creeks of Bluestone. The engineers are now making surveys for this branch.

From the recent report of Mr. A. S. McCreath on the mineral resources of the country tributary to the Shen. Val. and N. & Wn. railways, we take the following concerning the Flat-top coal-field.

"The building of the New River division of the Norfolk & Western railroad has practically solved the fuel problem, by opening the Great Flat-top coal region with its vast stores of the purest of coal, and one which promises to yield a coke equal to all the demands of large modern furnaces.

The coals of this region belong to the lowest member of the Coal Measures, and are equivalent to the Seral or Pottsville Conglomerate of Pennsylvania, where the group seldom contains coal beds of economical importance.

The beds of this series were examined by Prof. Fontaine on the lower New river in West Virginia, and the name of Quinnimont group was assigned to them by him. Later, the same series was studied somewhat in detail by Prof. Stevenson in the south-west counties of Virginia, as well as less closely along the waters of Laurel creek in Tazewell county, Virginia. A more detailed examination was made along another tributary of the Bluestone river by Maj. Jed. Hotchkiss."

"The value of the coals from beds of this group has been well determined from many localities along the New river in West Virginia. Samples were taken from the Coal branch and Nelson coal beds by Prof. Stevenson, the analyses of which are given elsewhere in this report. Numerous samples were taken by Major Hotchkiss, which were analysed, showing a close resemblance between the beds. The Quinnimont coal group attains its maximum importance in the vicinity of the Flat-top area. The beds are thick in Mercer county, W. Va., and in Tazewell county, Va.; but eastward and westward the group diminishes in value."

"During a recent visit to the mines of the South-West Virginia Improvement Co., at Pocahontas, samples were selected representing a complete section of the *Nelson bed*, from five different points as follows:

1. From air-way, and about ten feet from outcrop. 2. From first cross entry, one hundred and fifty-three feet from outcrop. 3. Main entry, left side, one hundred and sixty-five feet from outcrop. 4. Main entry, left side, one hundred and eighty-five feet from outcrop. 5. From same, two hundred and eight feet from outcrop. These different samples were crushed and intimately mixed previous to analysis, and they should fairly represent the character of the coal obtained in regular mining operations.

The coal bed has a sandstone and slate roof with slate floor. Its structure is as follows:

1. Coal, bony and not included in sample	0′	8″
2 Coal, with irregular thin slate streaks	4′	8″
3. Slate, not included in sample	0′	½″
4. Coal	6′	0″
5. Slate, not included in sample	0′	3″
6. Coal	1′	0″
Total thickness of bed	12′	7″
Thickness of coal to be mined	11′	8″

An analysis of the coal shows it to contain:

Water	.932	100.000
Volatile matter	20.738	
Fixed carbon	73 729	
Sulphur	.718	
Ash	3.984	
Phosphorus	0013	

This represents a coal of great purity, showing only a small percentage of ash and being practically free from phosphorus—points which will be readily appreciated by the intelligent iron master.

Although none of the ceal has yet been coked in ovens, laboratory experiments and tests in pits indicate that an excellent quality of coke can be made from it, containing not over five per cent of ash, and with an open cellular structure combined with great strength."

Graphite, the plumbago or "black lead" of common language, is known to exist in many localities in Virginia, in fact samples of it are often sent us, but to this time we do not know that any one has developed a mine where it exists in paying quantities.—Mr. N. C. Sheppard, of Richmond, Va., writes us that he wishes to buy large quantities of the "bright silvery looking" graphite, not the "black." We should be glad to have information of localities in Va. where this ore can be had, and statements of probable quantity, cost, &c.

Ochre deposits are very abundant in Virginia, especially among and near iron ore beds; it would pay those owning such deposits to open and prove them, especially if the color is a light yellow and the material has "body" enough to make a holding stain on the fingers when rubed between them. There are many calls for such an ochre just now.

Connellsville vs. New River Coke.

By Prof. Fred. P. Dewey, Chief of Met. Dept.
U. S. National Museum.

To the Editor of *The Virginias.*

Dear Sir:—I have read with considerable interest Mr. Fulton's article on the subject of coke in the March *Virginias*, and as the subject of porosity of rocks has been prominently in my mind for some time, I was in hopes Mr. Fulton's work would prove a valuable addition to our knowledge upon that subject, but in this I was sadly disappointed.

Without entering into the discussion of the relative value of West Virginia and Connellsville cokes, I would like, in the interest of truth and good work, to call attention to a few of the errors of the physical portion of the table on page 41. In columns V and VI of that table, the absurd blunder is made of comparing percentages by weight with percentages by volume; in other words, 100 parts of the Connellsville coke, for instance, are made up of 61.53 parts by weight of coke and 38.47 parts *by weight* of air-space, or else that 100 parts of this coke are made up of 38.47 parts by volume of air-space and 61.53 parts by volume of coke, the volume of the coke being exactly the same as the weight given in column I, both of which statements are absurd. Without applying the corrections for temperature, barometric pressure, etc., it may safely be assumed that in these experiments one gramme in weight of water approximately equals one cubic centimeter in volume, in which case the true volume of the coke can be found by dividing the weight in grammes, given in column I, by the specific gravity given in column XI, which will give numbers which can be compared with column II. Performing this operation and the necessary operation to show percentages we have:

	True volume of Coke; Cubic centimeters in one cubic inch.	True Percentage; Coke.	Cells
Connellsville	8.306	51.61	48.39
West Virginia	(8.956*)	(54.66*)	(45.34*)
Broad Top	8.763	51.00	49.00
Clearfield	9.480	65.16	34.84
Cumberland	7.291	45.12	54.88
Alabama	8.908	64.03	35.97
Illinois	9.103	60.51	39.49

*It is unfortunate for the sake of symmetry that the specific gravity of the West Virginia coke is not given. This want is in a measure supplied, however, by the use of the calculated number of cubic centimeters in one cubic inch; but in this particular case, as will be seen from the latter part of this letter, such a use of this number is not strictly allowable.

Again, the order of cellular space as given, makes a coke with 25.57 per cent of cells the same as one with 41.73 per cent, while a coke with 41.73 per cent of cells is rated as 1, a coke with only 41.01 per cent of cells is rated at 1½; the proper way would have been to call the coke with the largest cellular space, unity, and rate the others accordingly, by division, which would give;

Relative order in cell space from percentages given in table:

Connellsville	.9218
West Virginia	.8545
Broad Top	1.0000
Clearfield	.6127
Cumberland	.9827
Alabama	.6285
Illinois	.8677

This, however, is not the true cellular order as given by comparing the space occupied by the cells, which is as follows:

Connellsville	.8782
West Virginia	.8376
Broad Top	.9493
Clearfield	.5625
Cumberland	1.0000
Alabama	.5626
Illinois	.6694

Having examined thus far, I became suspicious of the accnracy of the whole thing and began an examination at the foundation to ascertain with what degree of accuracy the work had been performed, and I was surprised to find how inaccurately the work had been done.

Taking the volume of coke in cubic centimeters in one cubic inch, as given before, and adding it to the volume of cells obtained by subtracting column I from column II we have:

Connellsville	16.096
West Virginia	
Broad Top	17.183
Clearfield	14.550
Cumberland	16.16
Alabama	13.898
Illinois	15.043

As representing the number of cubic centimeters in one cubic inch, numbers which instead of being approximately the same, as they ought to be, differ among themselves to the extent of 3.285, while the maximum variation from the true number of cubic centimeters (16.386) in one cubic inch is 2.488; errors entirely too large to be set down as unavoidable.

Besides the attempt to draw conclusions from a single set of experiments, which is hazardous, the table contains other minor discrepancies, but I think I have said enough to demonstrate its entire lack of value, both on account of the want of care with which the experiments were conducted and the manner of making the calculations.

Yours, very truly,
Fred. P. Dewey.

Washington, D. C., April 7th, 1883.

Tin in Virginia.—At the session of the Association of American Geologists and Naturalists in Boston, in 1842, Prof. Wm. B. Rogers adverted to the occurrence of oxide of tin in Virginia associated with auriferous quartz and other minerals of some of the gold mines. As yet he had discovered it at only a few localities. It is in the form of very small crystals scattered at very wide intervals, and even where it occurs, is perhaps the rarest of all the metalic minerals found in and contiguous to the gold veins. In the two or three instances in which it was found in place, it was imbeded in a talco-micaceous slate, near its junction with the auriferous quartz. The minerals met with in the talcose and micaceous slates, which usually include the veins and beds of auriferous quartz, are: auriferous, common, arsenical and cupreous sulphurets of iron, sulphuret of copper, carbonate of copper, sulphuret of zinc, sulphuret of lead, sulphur in minute crystals lining the cavities of cellular quartz, metalic gold, peroxide of iron, phosphate of lead beautifully crystaline, oxide of tin and oxide of bismuth, both exceedingly rare.

Cost of Making Pig-Iron in Virginia and Pennsylvania.

In the recently published report of Mr. Andrew S. McCreath, chemist of the 2nd geological survey of Pennsylvania, on the mineral resources of Virginia along the lines of the Shenandoah Valley and Norfolk & Western railways, especially in The Valley and Apalachian districts of Virginia, a number of detailed estimates of the cost of making a ton of pig iron in the regions treated of in Virginia, are given—all prepared after a careful investigation of the actual local conditions controling such manufacture. These reliable estimates, tabulated for convenience of reference, are given below.

Mr. McCreath also presents, for comparison, statements of the actual cost of making iron at several iron-making centres in Pennsylvania, obtained from the iron-masters themselves. These are given below in a tabulated form.

Introducing his Virginia estimates, Mr. McCreath says: "All of these localities are in the midst of a rich agricultural country, amply able to provide for all the wants of an industrial community, and with an abundant and never-failing water supply.

That a good quality of neutral pig-iron can be made at these points at a minimum cost, there can be no doubt; and the following carefully-prepared estimates will show that this section can successfully compete with other localities where at present large iron industries are in a prosperous condition. These estimates are based, of course, on the erection of large modern coke furnaces; with coke (New River Flat-top), at $1.75 per ton at Pocahontas, and freight rates of not over one cent per gross ton per mile."

1. *Cost in The Valley of Virginia.*

	No. 1.	No. 2	No. 3.	No. 4.	No. 5.
Ore	$4.50	$4.73	$4.79	$4.79	$3.40
Coke	5.25	4.46	3.69	3.25	3.88
Limestone	.30	.50	.75	.60	.50
Labor	1.50	2.00	2.10	2.00	2.00
Incidentals	1.00	1.25	1.25	1.25	1.25
Total cost,	$12.55	$12.94	$12.58	$11.89	$11.03

No. 1 is the *actual present cost* of making a ton of coke pig iron at Milnes, on Shenandoah Valley RR., Page county, furnished by Mr. L. S. Boyer, secretary of the Shenandoah Iron, &c., Co., using 1¼ tons of ore at $2 a ton, and 1¼ tons of coke at $4.20 per ton.

No. 2 is the *estimated cost* of making a ton of pig iron at Buchanan, Botetourt county, a station of the Shenandoah Valley and Richmond & Alleghany RRs., using 2¼ tons of ore at $2.10 per ton, and 1⅛ tons of coke at $3.25 per ton.

No. 3 "is a carefully prepared estimate of the cost of making pig iron at Roanoke," Roanoke county, the junction of the Shenandoah Valley and Norfolk & Western railroads, using 2¼ tons of ore at $2.25 per ton, and 1⅛ tons of coke at $2.95 per ton.—A foot note states that Col. D. F. Houston, general manager of the Crozer Steel and Iron Co., (which has just completed a 100-ton blast furnace at Roanoke), puts the cost of making a ton of pig iron at that point at $12.60.

No. 4 is the *estimated cost* of making a ton of pig iron at Central, Montgomery county, the junction of the Norfolk & Western RR. and its New River branch, based upon the completion of the Cripple Creek branch of N. & W. RR., and using 2¼ tons of ore at $2.25 per ton and 1⅛ tons of coke at $2.60 per ton.

No. 5 is the *estimated cost* of making a ton of pig iron at the end of the projected Cripple Creek branch of N. & W. RR., at or near Speedwell furnace, Smyth county, 47 miles from Martin station of N. & W. RR., using 2¼ tons of ore at $1.60 per ton and 1⅛ tons of coke at $3.10 per ton.

The author adds: "It is believed that these estimates will fairly represent what can be accomplished in practical working operations, showing that pig-iron can be made at a cost of about $12 per ton. In each case the labor and incidentals have been charged at $3.25 per ton, which is probably in most cases too high, for in actual practice at Milnes these items are given as only $2.50."

2. *Cost in Pennsylvania.*

For comparison Mr. McCreath obtained from prominent iron-masters at different points in Pennsylvania and from one point in New Jersey, the *actual cost* of making pig iron at their furnaces, which tabulated is a follows:

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.		No. 6.
Ore	$9.37	$9.00	$9.34	$9.46	$7.60	$9.61	$11.81
Fuel	5.02	5.40	5.30	5.64	7.00	6.67	3.39
Limestone	1.00	.85	.77	.42	.56	.95	.77
Labor	2.35	2..0	2.33	1.50	3.00	2.45	2.00
Incidentals	.48	1.00	2.64	.76			
Total cost,	$18.22	$18.35	$20.38	$17.87	$18.16-19.68		$17.97

No. 1 is the actual cost of making pig iron in Middle Pennsylvania with mixed anthracite coal and coke for fuel.—No. 2 is the cost at Harrisburg, Pa., using 2¼ tons of ore at $4 a ton, and 1¼ tons of anthracite coal costing $3.60 per ton.—No. 3 is the cost in the Lehigh Valley district; repairs are included in the item for incidentals.—No. 4 was the cost at Phillipsburg, N. J., in 1881.—No. 5 is the cost in the Lower Susquehanna, Pa., district, at two furnaces a considerable distance apart and on two different railroads.—No. 6 is the cost at Pittsburg, Pa., using 1¼ tons of Lake Superior hematite, containing 55 to 58 per cent metalic iron and costing $6.75 per ton.

The average of above statements of the actual cost of working pig iron at seven different points in Pennsylvania, is $18.66 per ton; in other words, the cost of making a ton of iron in the State of Pennsylvania at this time is $18.66 a ton.

Mr. McCreath concludes as follows: "Any comment upon these comparative estimates would be superfluous. They show conclusively that pig-iron can be made at numerous points along the line of these railroads to such advantage that—apart from the local demand for it which the development of the country will undoubtedly make—it can bear long transportation to markets and successfully compete with any other locality, and yet leave a handsome profit for capital judiciously managed.

The advantages which the territory traversed by these several lines of railroad offers to the iron-master may be summed up in a few words: The ores are abundant and generally of good quality; they can be economically mined, for the country in many localities is broken up by numerous ravines affording natural openings for mining operations; most of the deposits are within convenient distance of the railroads—with easy down grades; the water supply, either for washing ore or for manufacturing purposes, is ample and permanent at all seasons; limestone for fluxing purposes exists in unlimited quantities; coke of the finest quality for blast furnaces can now be obtained at a reasonable cost; and the railroad facilities for reaching markets in every direction are unusually good—thus forming a combination of favorable circumstances rarely equaled."

Notes on the Geology of West Virginia.

The Geology of Cheat River Cañon in Preston and Monongalia Counties.

By I. C. White, Prof. of Geol. and Nat. Hist., W. Va. University.

(Continued from page 189 of 1882 Vol.)

Continuing south-eastward up the river, the rocks rise with great rapidity, and at one mile and a half above the last locality, only 2½ miles from where the top of No. XII first emerges from the bed of Cheat, we get the following succession in descending the almost vertical wall on the right bank of the river (Sec. 4):

1. Very massive pebbly sandstone	20′	No. XII.	
2. Concealed	80′		
3. Sandstone, massive, coarse	20′	165′	
4. Concealed	45′		
5. Shales and concealed	20′	Mauch shale.	
6. *Red shale*	10′	295′	Chunk
7. Sandstone, greenish, current-bedded	165′		
8. *Red*, and green shales and concealed	50′		
9. *Limestone*, impure	10′		
10. Shales, green and red	25′		
11. Flaggy sandstone and shales	15′		
12. *Mountain limestone*, in layers 1′—10′ thick separated by thin calcareous shales	95′		
13. Sandstone, finely laminated, and containing *pebbles of limestone*	10′	No. X.	
14. "Silicious limestone," grayish-white	5′		
15. Sandstone, flaggy	10′	305′	
16. Sandstone, massive, pebbly, current-bedded	80′		
17. Concealed to level of Cheat river (875 A. T.)	200′		

I have placed the base of No. XII in this section, 45′ below the top of the concealed interval, since the band of *red shale*, No. 6, is evidently identical with the one in Sec. 2, which comes 20′ below the base of XII. This gives a thickness of 165′ for the latter at this locality, and since 10′-15′ have been eroded from its top, the group when complete would have about the same thickness as found in Sec. 2 (177′).

The *Mauch Chunk shale* foots up a thickness of 295′ at this locality, which is so near that given by the combined section and boring in Sec. 2 (300′), that the latter figure may be taken as the average thickness of these beds along the Cheat River cañon through Chestnut ridge and Laurel hill.

The sandstone in No. 7 gets quite massive at times, and this portion of the column makes a great bluff along either bank of the river, from which the descent to the stream is almost vertical in many places.

As will be seen by comparing the sections, the interval between the *Mountain limestone* and the 10′ *impure limestone* above, is in this section just double that in Sec. 3, showing that it is quite variable.

The *Mountain limestone*, No. 12, juts out of the bluff in a great cliff at this point, and was once quarried for flux for the old Henry Clay furnace, situated near the head of Quarry run.

No. 14 seems to be identical with the "Silicious limestone" of Stevenson in Fayette and Westmoreland counties, and is here clearly a portion of No. X, since 10′ of *Pocono* or *Vespertine sandstone* comes above it.

No. 16 is a massive, hard, gray sandstone, containing streaks of small quartz pebbles, and forming an immense cliff along the mountain side.

About one-fourth mile above the last locality, another section taken on the same (east) bank of Cheat river reveals the following structure (Sec. 5):

1. Massive sandstone and conglomerate, making lower half of No. XII	100′		
2. Concealed	50′	Mauch shale.	
3. Sandstone, flaggy, and current-bedded	160′	292′	Chunk
4. Layer of breccia	2′		
5. Concealed and red shale	40′		
6. *Limestone*, impure	5′		
7. *Red shale*, and concealed	35′		
8. *Mountain limestone*, visible	85′		
9. Concealed	25′		
10. "*Silicious limestone*,"	10′		
11. Sandstone, massive, pebbly	100′	No. X	
12. Concealed with flaggy sandstone at base	175′	435′	
13. Concealed to Cheat river (885′ A. T.)	150′		

This section is but a repetition of the preceding one, with slight variations, the *Silicious limestone* being here 10′ thick instead of 5′. It is a light gray rock, containing possibly 40-50 per cent of lime, and would make as good pavement blocks as that from Westmoreland county, so extensively used in Pittsburg and vicinity.

No. 4 is a curious layer of shale, iron ore, and sandstone pebbles cemented into a matrix of impure limestone.

The rocks still rise quite rapidly south-eastward as we approach the *Chestnut Ridge axis* which crosses Cheat river about one mile and a quarter above the locality of Section 5.

About one-half mile south-east from the locality of the last section, a small rivulet falls over the base of No. XII, and completely exposes the beds at the junction of No. XI, with the former, exhibiting the following in descending the steep east bluff of the river (Sec. 6):

1. Conglomerate, very massive	100′		
2. Sandstone, coarse, few pebbles	50′	No. XII.	
3. Shales, sandy, buff, containing some iron ore	20′	180′	
4. Sandstone, massive buff	10′		
5. Shales, yellow and green, containing iron ore	30′		
6. Sandstone, greenish, somewhat flaggy	140′	Mauch shale.	
7. *Layer of breccia*, calcareous	2′	293′	
8. Sandstone, green, flaggy	20′		Chunk
9. *Layer of breccia*, calcareous	1′		
10. Shales, red and green	45′		
11. *Limestone*, impure	10′		
12. *Red shales*, and flaggy sandstone	45′		
13. *Mountain limestone*	100′		
14. "*Silicious limestone*," and Pocono sandstone	125′	No. X.	
15. Concealed to level of Cheat river	450′	575′	

I was at first disposed to place the line between Nos. XII and XI at the base of No. 2 in the above section, but the massive yellowish sandstone, No. 4, so unlike anything usually found in No. XI, determined its base as the true dividing horizon between the two series. This is also confirmed by the thicknesses which result from placing it there, viz: 180′ for XII and 293′ for XI shales, which are almost exactly the same as found for each in Sec. 2.

The "*Silicious limestone*" is 10′-15′ thick at this locality and as usual passes insensibly into the great sandstone deposit below.

A few rods further south from the last locality another measurement of the beds gave this result (Sec. 7):

1. Massive, pebbly sandstone	150′	No. XII.	
2. Shales and shaly sandstone, buff	35′	185′	
3. Shales, greenish, sandy	30′	Mauch shale.	
4. Sandstone, greenish-gray, flaggy	90′		
5. *Red, and green shales*	12′		
6. Sandstone, greenish, massive at top, flaggy and shaly below	65′		
7. *Brecciated limestone*	2′	293′	
8. *Red and green shales*	25′		Chunk
9. Blue sandy shales, and green flaggy SS	25′		
10. *Limestone*, impure, fossiliferous	10′		
11. Red and green shales and sandstone	40′		
12. *Mountain limestone*			
(*a.*) Massive limestone in layers 1′—5′ thick, sparingly fossiliferous	25′		
(*b.*) Shaly limestone and calcareous shales, very fossiliferous, especially rich in *Productus*, *Spirifer*, *Athyris*, *Lophophyllum* and *Crinoidal columns*	5′	110′	
(*c.*) *Limestone*, gray, good, few fossils	45′		
(*d.*) Shales and limestone	35′		
13. "*Silicious limestone*," passing gradually into sandstone below	30′		
14. Sandstone, massive, pebbly, current-bedded, making cliffs	100′	No. X. 605′	
15. Concealed to level of Cheat river	475′		

Here the "*Silicious limestone*" runs down into the underlying sandstone to a depth of 30′ and finally fades into sandstone so imperceptibly that it is impossible to fix the line between the two.

Just above this locality, about one-fourth mile, the *Chestnut Ridge axis* crosses Cheat river, four and a half miles from Ice's Ferry. At the latter locality the top of No. XII is 300′ under the river, while here at the axis its top comes about 1300′ above Cheat river, or 1400′ higher than at Ice's Ferry, since the stream falls nearly 100′ between the two points.

Here, at the crest of the axis, the Great Conglomerate makes a broad but gentle arch, being almost horizontal for nearly a mile and a half. Its outcrop is traversed as usual by great intersecting fissures which are often 3′-4′ wide, and separate the stratum into immense blocks, some of which, 50′ on a side, have toppled over into the steeply sloping edge of the cañon, and look from a distance as though a slight push would dislodge them into the great chasm beneath.

The scenery along the crest of this great arch is the grandest and most picturesque to be found on this river, famous for its wildness for a distance of nearly 200 miles. There are two points from which the outlook is especially fine, one of these known as *Hanging Cliff View* is on the east side of the river and about one mile above the locality of the last section. Here the river bends sharply westward and a long, narrow ledge of No. XII sandstone, extends in a bold cliff far out into the main course of the cañon. From this elevated point, the eye takes in a radius of 25 to 30 miles for nearly three-quarters of the horizon; to the southeast one looks up through the great gorges carved by the river out of Laurel hill and Briery mountain, to the vicinity of Rowlesburg (30 miles distant), where on a clear day, the white puffs of steam and smoke from the B. & O. RR. engines may be distinctly seen, as the heavily laden trains wind up the steep slopes of the Alleghanies to Cranberry Summit, the lofty peaks of whose surrounding mountains loom proudly against the horizon. To the west and north, the eye has an unobstructed view down the cañon and out over the fast receding walls, to the great plateau of the Coal Measures, which, sculptured into endless forms of hill and dale, stretches away to the limit of vision, in delightful contrast to the rugged mountains on the east. Add to this the wild dash of the river as it rushes along over its rocky bed more than a thousand feet almost vertically below, disappearing in a silver thread far up and down the cañon, and we have a picture enchanting in the extreme.

The other point is Brock View, named in honor of the late Dr. H. W. Brock, of the W. Va. University, who first discovered the beauties of this portion of the cañon. It is on the opposite side of the river from the Hanging Cliff, nearly one mile below, and is scarcely inferior in grandeur to the latter.

In descending from Hanging Cliff View to the river the following structure is visible (Sec. 8):

1. Massive conglomerate	75′	No. XII,	
2. Concealed to base of XII	110′	185′.	
3. Concealed	190′	Mauch Chunk shale. 300′	
4. Shales, red, green, &c., containing an impure limestone just below the centre	100′		
5. Sandstone, greenish-gray, current-bedded	10′		
6. *Mountain limestone*	95′		
7. Concealed, with occasional showing of limestone and shales	60′		
8. Concealed to level of Cheat river	425′		

In descending from the same Hanging Cliff to a point one-half mile further up the river, and just below the "Beaver Hole," the following succession was observed (Sec. 9):

1. Massive conglomerate, visible	65′	No. XII,	
2. Concealed to base of No. XII	120′	185′.	
3. Concealed	60′	Mauch Chunk shale. 295′	
4. Sandstone, green, flaggy	25′		
5. Concealed, but showing frequent outcrops of green, flaggy sandstone	195′		
6. Sandstone, green, massive, visible	5′		
7. Concealed	10′		
8. *Mountain limestone*	120′		
9. "*Silicious limestone*"	30′		
10. *Pocono sandstone*, massive and pebbly at top, hard and flaggy below to the level of Cheat river	425′		

The *Mountain limestone* contains some extensive caverns along Cheat river, and one not far from the locality of this section has been named the *Eagle Cave*, from the fancied resemblance of one of its stalagmitic accumulations to the outspread figure of an eagle. It has been followed into the mountain side for several hundred yards, and those who have explored it, report some extensive rooms in this cavern.

The "Beaver Hole" mentioned above is a locality just above the Hanging Cliff View, where the current of the stream flows around the circumference of a circle about 150 yards in diameter, and is six miles above Ice's Ferry by the river, but probably not more than five in a direct line.

Continuing up the river from this point towards the southeast, the rocks dip rapidly down, and when we come to the mouth of Sandy creek, four miles above the Beaver Hole, the top of No. XII is only 400′ above the level of the stream, instead of 1300′ at the crest of Chestnut Ridge axis. Here at the mouth of Sandy creek we are in the centre of the great trough or syncline between the Chestnut Ridge and Laurel Hill axes. This syncline enters Preston county from Fayette county, Pa., and extends in a south-west course entirely across Preston. The trough is about seven miles wide (from Chestnut Ridge axis to Laurel Hill axis) on Cheat river, but opens out rapidly south-westward from the dying down of its western rim (Chestnut Ridge axis), so that at the B. & O.RR.,near Independence, its breadth is not far from 12 miles.

(To be continued.)

Notes on the Mineral Deposits at certain Localities on the Western Part of the Blue Ridge.

By Wm. M. Fontaine, Professor of Geology in the University of Virginia.

(Continued from page 47.)

Iron and Manganese Ores at Sherando.—A short distance below, or to the N. E. of the village of Sherando, Back creek flows in the clay formed by the decomposition of the Ferriferous shales of the Potsdam. These clays are here yellowish, pinkish, and brown in color. The latter sometimes pass into a handsome brown ochre or umber. On Mr. Wagner's place, in the bed of the creek, there is an interesting exposure of the clay, showing the manganese in process of formation by concretionary action. Here, as usual, the ore is mainly Psilomelane or hard manganese, but in this place the masses have some Pyrolusite and Manganite, the softer varieties of manganese oxide, in the cavities of the material, or forming seams in the harder ore. Lumps and crusts of the manganese may be seen embedded in the clay, and they are plainly now in process of formation. The manganese seems to be finely diffused through the dark brown umber, and to be gradually concentrated out of the clay in lumps and crusts. In some cases crusts of manganese may be seen enclosing the clay, and the nodules often show enclosed clay. Mr. Wagner recently sank a shaft on an exposure of manganese in the old bed of the creek, going down 26′, and starting with a large lump of manganese in one corner of the shaft. The mass of ore, as he says, continued in the same corner to near the bottom, where the slight dip of the ore caused it to pass out to one side. But in sinking, according to his statement, a series of lumps forming a stratum, began to come in, and near the bottom they occupied most of the shaft. He took out in sinking about 5 tons, but left a large amount. A freshet in the creek coming on, filled up the excavation. Other excavations made in the field a short distance from the bed of the creek, in former times, are said to have yielded a good deal of the ore. Judging from these excavations, and the manner in which the mineral is found in the bed of the creek, it does not occur in a definite vein or deposit, but may be found in pockets and masses here and there, imbedded in the clay over a belt 75-100 yards wide. I have no doubt that the amount of ore here is large. Mr Hiseman's land adjoins that of Wagner. About 75 yards to the S E. of the exposures in the creek, Sibert in 1859, took out of an open cut on Hiseman's land, a good deal of manganese, said to have been as much as 200 tons. His work was stopped by the pits being filled up owing to freshets. At this latter place a large deposit of dark brown umber, containing manganese, is visible in the bank and bed of the creek. It looks as if it would make an excellent paint. In several places in this region, the Ferriferous shales show promising ochres and clays, and no doubt careful exploration would disclose deposits of value. This locality would afford a good site for the manufacture of these materials. The S. V. RR. is only 2½ miles distant.

About ½ mile N. E. of the village of Sherando, there is a narrow topped ridge with its crest composed of the flags and shales that underlie the Potsdam quartzite. This latter rock apparently forms the N. W. face of the hill. Of this latter point I am not positive, as no detailed examination of the rocks was made. In this hill, and near its middle portion, considerable deposits of limonite occur, that are exposed by shallow pits on the land of Mr. Hiden. They are reported to extend farther N. E. As a general truth, most of the iron deposits mentioned as occurring at given localities along here, are not limited to the immediate locality inspected by me, but may be traced N. E. and S. W. I visited only those points that were exposed by openings, and where the ore could be taken as the type of the material. In the hill now in question, the ore is of two kinds, a dark brown, to nearly black material, and a pale brown to yellow. The exposures are not sufficient to disclose the precise relations of these two kinds to each other, but I conclude that they form two parallel lines of ore deposits, that run close to each other. They are found mixed together in the same openings. They both occur impregnating the flags and shales, or replacing them, apparently along fissures, the latter being the ore most free from rock and earthy impurities. The dark ore is always the most solid and free from argillaceous or silicious admixture, and is generally a massive ore. It shows solid ore ledges 3½′ to 5′ thick. The light colored ore is more mixed with earthy matter, and a larger portion of it is an argillaceous lean ore. Still a good deal of it has the appearance of a pretty fair material. The dark ore seems to have been deposited in a more widely opened fissure, and is less interstratified with the wall rock than the yellow or pale brown ore. Indeed it is generally true that the ores occurring under the Potsdam quartzites in the rocks of No. 4, show these differences of character. The yellow and light brown ores are usually interstratified with the shales and flags or replace and impregnate a band in them. They consequently are more argillaceous and siliceous than the dark ones which, in part at least, are remarkably free from earthy matter, giving a dense, solid ore, that always occurs in fissured portions of the rock, or crushed bands. This dark ore, however, commonly shows a comparatively high percentage of phosphorus, and is usually known as "cold short ore." This dark ore was at one time used in Mt. Torrey furnace, and according to the account of a man who worked in the furnace at the time, made an iron that was quite white in color, very easily melted, and very brittle when cold. The amount of ore here seems to be quite considerable. I was informed that a deposit of hematite occurs farther east on the Howardsville road, but could find no one who knew its location to guide me to it. It probably is found in the red shale horizon. These hematite ores probably occur also on the land of Daniel Shaw, 1½ miles S. W. of the village. The specular ledges of the rocks of No. 3, are found on his place, and one of them, probably the one opened at the fault in the Mt. Torrey section, has an unusually large amount of iron, being better than that quarried at Mt. Torrey. It would probably serve to mix in small amounts with the aluminous ores of the Ferriferous shales.

A specimen of the lean brown ore on Hiden's land, showed on analysis, 41 per cent of metallic iron, 30 per cent of silica, and 1 per cent of phosphorus. The dark ore from the same locality, showed 57 per cent of metallic iron, .9 per cent of manganese, and 1.4 per cent of phosphorus. The specular ore of Mr. Shaw, showed 29 per cent of metallic iron, and 54 per cent of silica.

*At Mt. Torrey, as it will be remembered, in the section made towards the Azoic of the Blue Ridge, it was stated that a quarry was opened on a specular ledge that disclosed a fault. This ledge has the specular iron such as is shown at Rockfish Gap and at other points farther S.W. About 600 lbs of this ore was mixed at one time, with the furnace charge of the Ferriferous shale ores, and this addition was said to have greatly improved the quality of the iron produced. It has too much silica to be used in large amounts.

Mount Torrey Ore Beds.—The geological position of the Mt. Torrey ore beds was indicated in the Mt. Torrey section.

*It will be borne in mind that the geological portion of this report has been omitted. Such references as this relate to the geological portion of the report.

They occur on the N. W. face of Mt. Torrey in the Ferriferous shales. There are no exposures of rock in connection with them, but the ore occurs imbedded in clay of great depth. In the earliest working of the beds here, as elsewhere, the ore was obtained by open pits on the outcrop. This mode of working was carried on always as long as possible, for the expense of shafting and removing the water, as well as the hoisting of the ore and the secure timbering of the underground works in the soft clay, was considerable. It has often happened in the working of these ore deposits, that when the time came at which the ore could no longer be obtained in the outcrops, by simple pits, the furnace men preferred to haul ore from long distances and over rough roads. The result has been that most of the outcrops of ore in the Ferriferous shales, and adjoining rocks have been removed, and now it is difficult to get any idea of the true nature of these deposits. There is no doubt that in many cases the deposit is practically untouched, and that beneath water level no ore has been removed. Only where the ore-bodies are of exceptionable size and purity, have they been followed by any considerable underground works. On the outcrops, of course, the only ore now visible is that which was rejected, and as all the workings are very old, they do not show their best ore. This fact should be borne in mind, for my account of the several deposits must consequently be based upon observations made under the most unfavorable circumstances. It is precisely those deposits that have been worked most underground, that now show least on the surface. At Mt. Torrey there seem to be two lines of ore deposits of different character. We cannot in strictness call any of the deposits of the Ferriferous shales, veins, or ledges, although ore may be, and usually is, found along certain definite bands. The deposits are lenticular masses, or interrupted sheets of ore, that occur sometimes alone, and sometimes overlapping "en echelon," or more rarely radiating from a central point. Lines connecting the several masses in the direction of their greatest dimensions, would fall within certain bands, and one mass may lie in the same line with another so as to produce the appearance of one ledge or vein. The sheets and masses will, however, be found to be entirely enclosed in clay, and they are all formed by the concentrating action of concretionary forces, that have collected this once diffused iron into masses, that have more or less distinctly a concretionary structure, or that form beds of nodular ore or crusts lying in and enclosing clay. These features that are found generally, occur also in the Mt. Torrey ores. The more westerly line of deposits seems to have been most extensively worked, and here a good deal of the ore has a rich dark brown color, although, perhaps most of it has rather a light brown color. The other line of deposits occurs about 200' N. W. of the above mentioned one, and contains reddish, light yellow, and yellowish brown ores, much of the material being honey-combed or cellular from containing clay within the shells of ore. Some of this ore has the color of red hematite, and has no doubt a less amount of water than the rest of the ores. Some of the dark brown ore was selected for examination, on account of its resemblance to the ore of Mike knob, and Hiden's dark ore, the darkest being taken. It contains 56.74 per cent of metallic iron, 2.33 per cent manganese, and .722 of phosphorus, being thus in chemical nature also, close to the Mike knob ore. The other ores are, I think, much freer of phosphorus, as this was selected on account of the greater proportion of this material that it seemed to have. The occurrence of the ores in the most easterly band could not be made out, as the cuts were all full of water. In the western belt the workings have been from the surface only, and mostly in an open cut. This shows now only the lean ore that has been left. It occurs in the form of a thick ledge, made up of crusts and shells of a shaly ore, containing numerous enclosures of clay. The good ore was obtained from the side of this ledge, and in front of it, and this is not now visible, as the excavations made for it are filled up. Much of the ore taken out here had the shelly, hollow structure, shown in the ledge now left standing It was broken and washed to remove the clay contained in the cells. The clay mingled with the material in the standing ledge, is yellowish or whitish, and sometimes it is a pure kaolin, but this latter is very limited in amount. Not counting the impure ledge left standing, which will yield some workable ore, the thickness of the richer ore here is perhaps 15'. It is quite probable that the ledge, if followed, will pass into good ore. Comparatively little work has been done here, as this forms the latest workings. The principal workings are the old ones on the more easterly deposits. We have in these quite extensive open cuts from which a large amount of ore must have been taken. The open cuts were succeeded by a shaft 60' deep, and from this gangways were driven into the ore. The shaft was sunk in the bottom of the principal cut.

These ores were utilized in Mt. Torrey furnace, one mile distant on Back creek, and were, in the later workings of the furnace, conveyed to it by means of a tramway. The furnace was built in 1804, and has been worked irregularly for considerable lengths of time, with long intervals of repose. It has been changed so as to use the hot blast instead of the cold, which for the most of the time of its working was employed.

Ores of the Kennedy Tract.—The Kennedy tract is an extensive body of land that stretches from the Mt. Torrey tract to Bare bank. It runs along the northern face of the expanded Primordial area, and contains several miles of the Ferriferous shales. Very little has been done in the way of utilizing the ores on this property, and most of the ore is still untouched. At intervals in this belt, deposits of both iron and manganese have been found, and partially exposed by openings. All of these deposits occur in the clays formed from the Ferriferous shales, and have the same general mode of occurrence as the other deposits in these shales. On this property we may recognise two ore-bearing bands, the more southerly of which has much manganese, both in distinct deposits, and mixed with the iron, forming ferro-manganese. These iron ores are dark to black, according to the amount of manganese present. The ores of the more northerly belt, which is several hundred feet distant from the southerly one, are very pure, light chestnut brown, or yellowish brown in color, and show no manganese at the points where I saw them. It may, however, well be, that this character is not universal, as I made no extensive examinations of localities on this belt.

The Ferriferous shales on the Kennedy tract form a belt of considerable width, that rises next to the quartzite exposed in the mountains forming the plateau expansion of the Primordial, quite rapidly, and attains a considerable height, forming a foot-hill to the quartzite mountains. It is in this higher portion, which sometimes assumes the form of a ridge, that the more southerly band of deposits occurs. The soil for a long distance in this ridge and its northern slope, is colored cinnamon, or chocolate brown, even when no exposures of ore occur. This coloration is probably due to diffused manganese and ferro-manganese. This belt is 200—300 yards wide, but it is not uniformly and everywhere thus colored. On the top of this ridge, and in the more northern portion of this tract, several small pits have been opened in the belt of brown colored clay above mentioned. The deepest of the pits are put down only 10'—12', and have a width of about the same dimensions. Most of the

ore disclosed by them is formed of a dark to black ferro-manganese. The manganese occurs in bands and films ¼" in thickness, and under, in a yellowish brown limonite. These manganese layers are often apparantly pure Psilomelane and occur so abundantly as to make up a considerable portion of the ore. The ore is nodular in form. Some dark ore like that at Mt. Torrey occurs. Sometimes the nodules are composed wholly of manganese. In some places a good deal of rich, solid, brownish limonite occurs in the form of separate and distinct masses. This mode of occurrence of mingled manganese and iron is, as we shall see, quite common in certain portions of the Ferriferous shales, and characterizes the deposits of some localities. Usually the ore possessing films of manganese has more of a shaly structure, and is more soft as if somewhat argillaceous, while the unmixed ore is massive and harder. The ore seems to occur here in pockets, but the openings are not sufficient to show the extent of the individual deposits.

A strong chalybeate spring occurs some distance to the N. W. of these first openings, and about 300 yards beyond this a pit was dug about the year 1872, by a Mr. Armistead in search of iron ore. It was carried to the depth of 20', and disclosed a deposit of Psilomelane, as I am informed, and then was abandoned as Mr. A. said he was not in search of this material. It is reported that a large amount of manganese in the form of boulders imbedded in clay, was left in this pit. Some of the ore is still lying in or around the opening, and an analysis of it shows of metallic iron 13.91 per cent and of metallic manganese 30.52 per cent, showing that it is a highly manganiferous ferro-manganese. It would seem that such an ore would be adapted to the manufacture of spiegeleisen. Near by this, is another pit dug in 1859, for manganese, and it is reported that 100 tons of manganese were taken out of this opening. Some of the ore is still on the dump, and appears to be quite pure. Since the above was written, this manganese ore has been analyzed in the laboratory of the University of Virginia, with the following results: Metallic manganese 43.30; metallic iron 3.88; sulphur .083; phosphorus .052; barium 6.93.

On Gum branch, beyond the old Kennedy furnace, there are several openings that appear to be made on the northerly ore belt. These openings were made to obtain ore for the Kennedy furnace. As they are now partly filled up, I could not see the mode of occurrence of the ore. Several tons of the material taken out are lying around the pits. It is a beautiful solid light brown ore, very free from earthy impurities. The analysis shows 57 per cent of metallic iron, no sulphur, and .2 per cent of phosphorus. The Kennedy furnace was built on Kennedy branch, and now shows nothing but the ruins. It dates perhaps from the first part of the century, and does not seem ever to have made much iron. The indications on the Kennedy tract are favorable for the existence of a large amount of good ore. Three kinds at least may be probably found in quantity. They are the mixed iron and manganese, the pure manganese, and the pure iron ores. These ores lie about 3 miles from the S. V. RR. Numerous bold streams issue from the plateau of Primordial rocks, and flow through the property. On these, and especially on Kennedy creek or branch, good sites for a furnace could be obtained. A little west of the last mentioned ore deposits, at Tuckahoe camp on Coles run, the Potsdam quartzite, as was mentioned in another connection, may be seen dipping N. W., and arching over to the S. E. Farther on to the S. W., at Russell rock on Love run, this rock has a steeper N. W. dip.

Bare Bank Ore Deposit.—This ore deposit occurs on the N. W. face of Bare mountain in the Ferriferous shales, and close up to the Potsdam quartzite, that with a N. W. dip forms Bare mountain. It is situated a little S. W. of the northern apex of the horse-shoe expansion of the Primordial. This bank has a fine reputation both for the amount of ore contained in it, and its good quality. The workings show that a large amount of ore has been obtained here. The only visible ore in place is that which was left as too lean to be worth removal. The old excavations are filled up, and hence little could be seen in that locality. Much of it seems to have been obtained by open cuts. Two ledges of lean, shaly ore are now visible, projecting from the clay. They have a concentric structure, and are made up of shells of argillaceous ore enclosing more or less clay. The good ore has been worked out from around and between these ledges, and is of course not now visible. The entire width of the mass of ore including the ledges now standing must have been over 30'. Of this thickness the lean ore forms about 12'. It is said that a good deal of very pure and highly plastic kaolin was found in some places between the ore shells. Some of this was used at Porcelain. A little of this kaolin is still to be seen where it has been thrown out in stripping the ore. It is very tenacious and seems to be quite pure. Some impure kaolin is seen in place in the wall of the deposit, but this is worthless. Some of the better ore of the deposit may be picked up on the dump and from this the material seems so far as physical characters go to be a very good article. The analysis of the lean ore shows 36 per cent of metallic iron, and a good deal of silica.

Glass Sand near Greenville.—In the alluvial, or drift covered level country, called "the Pines," or "Piney woods," that runs around the foot of the Potsdam mountains, we find, a short distance S. E. of Greenville, and near the saw mill of Larew & Newton, a curious deposit of Potsdam boulders. A well was dug to obtain water at this spot, and after passing through about 6' of blue clay, it entered a mass of Potsdam boulders and sand, which it penetrated for 17' as reported, without passing through it. On passing this locality I was struck with the extreme whiteness of the material taken out of the well, and was led to examine it. Much of the material was in the form of rounded boulders, a foot or more in diameter, composed of a pure white agglutinated sand. This is so friable that it can be easily crushed between the fingers, and resembles granulated sugar. The boulders clearly come from the friable band in the Potsdam quartzite mentioned as occurring pretty constantly in that rock. The material here seems to be exceptionally pure, and the boulders, evidently at first firm enough to bear transport for a long distance, have undergone a change by which the cohesion of the grains of sand has been destroyed. The amount of this material seems to be considerable, and it will, no doubt, prove valuable for glass-making. A trial of some of it in a soda-bead with the blow pipe, shows a very faint coloration from iron, not enough to injure it for glass making. Search will probably show a large amount of this material under the surface of this district. This deposit is about one mile from the line of the S. V. RR.

Greenville Stalactitic Marble—About ½ of a mile S. W. of Greenville, on the stage road, is a deposit of stalactitic marble, that has attracted some attention. It occurs in a nearly vertical fissure in the limestone, and was deposited from solution in water just as the material of stalactites is deposited. The ledge is about 18" wide at the top, but expands in descending, until at the bottom of the opening, which is 20' deep, it is 2½'–3' wide. The material does not fill the crevice with a solid sheet from wall to wall, but seems to have been formed in successive layers. These are sometimes consolidated together, and give pretty thick masses, but often open spaces occur between the sheets. The stone is light brown, yellow or gray in color. Often these colors

are handsomely banded concentrically. It takes a good polish, and makes a very ornamental stone. The only question that can arise is as to the amount of workable material in the crevice. Attempts have been made by a northern company to work it, but they gave it up as the deposit was then too far from a railroad. The Ches. & Ohio Ry. at Staunton, 13 miles distant, was then the nearest railroad, but now that the S. V. RR. passes but a short distance from Greenville, this difficulty is removed. Near Greenville there is a ledge of granular crystalline dolomitic limestone about 10′ wide, interstratified with the other limestone, and certain bands of the limestone are handsomely veined black and white. These strata may prove to be of value as a source of ornamental stone. The alluvial ground of the Piney woods is underlaid by clays, sands and shales, and, no doubt some of them will prove to be valuable.

From the Bare bank to the Tye River Gap road, the trend of the Potsdam quartzite mountains that form the most westerly ridges overlooking the limestone country to the northwest, is about 45° E. of N. The quartzite dips steeply N.W. and has along its N. W. side the clays of the Ferriferous shales. These clays contain a succession of deposits of iron ore, and sometimes of manganese, most of which have been worked to some degree and some of them quite extensively. The iron ore was used in the Cotopaxi and Vesuvius furnaces. These furnaces, however, never were worked on such a scale as to justify their volcanic names, as they were both small charcoal, cold-blast furnaces. The description of the ore deposits along this belt comes next in order. Some good ore has been found a considerable distance in front of, or to the N. W. of the Potsdam ridges, and near to the limestone. These deposits are apparently pockets. The principal ores occur near to the quartzite, and in the ridge forming the foot hills of these mountains. Newton's Pond field and Finley ores are some of the pocket deposits near the limestone.

Doyle Property.—This lies next to Bare bank and on the S. W. of it. Here a good deal of surface ore occurs, but there seems to have been little search made for ore, at least no considerable openings have been made. The float ore, however, looks well, and there is a good prospect for ore in considerable quantity.

Blue Bank.—This bank occurs on the land of Mr. Morrison, 2 miles S. W. of Bare bank. The ore was exposed by a pit now nearly filled up. The iron was used in Cotopaxi furnace, but according to Mr. Taylor, who worked it, it had too much manganese to be used as an iron ore. Mr. Taylor says that a considerable mass of the ore was left in the bottom of the pit. Some of this ore is to be found around the old excavation. It is evidently largely composed of manganese, and the blue-black color of this material gave the name to the bank. A tunnel was started from lower down the hill and driven in towards the ore deposit disclosed in the pit. The tunnel, a short distance from its entrance, passed into an extensive bed of highly manganiferous clay or wad, and does not seem to have passed through it. This wad has a large amount of fine particles of manganese diffused through it, and some lumps up to the size of a hen's egg. The wad has a bluish color. It may be that a large deposit of manganese and manganiferous iron ore exists here, as there seems to have been but little exploration made after the iron ore was found to be unfit for working.

Fairfield Ochre.—About ½ a mile from the village of Fairfield, in Rockbridge county, and 5 miles from the S. V. RR., is a deposit of red ochre that may prove to be valuable. I did not visit the locality, but saw specimens of the ochre. It has the color of red hematite, with the general character of reddle, being very fine grained and rather firm in texture. It is most tenacious in its coloring properties. The color left on the fingers in handling, is with difficulty removed. The feel is decidedly greasy. I was informed that there is "a whole hill" composed of the material. If it is in sufficient quantity, it will prove valuable as a paint. The deposit is on the land of Major D. Vines.

Black Rock Ore Bank.—This ore deposit occurs a short distance S. W. of the Blue bank. It has the reputation among those acquainted with the ore deposits of this section from having worked in them, or having seen them when actively worked, of having a larger and finer body of ore than any of the others. The openings were in the usual condition found at all the extensively worked deposits. All of them are filled up, and as the later workings were under ground, and the surface ore has been removed, but little is now to be seen at the locality. There are many extensive open cuts at this place, the most important of which is over 200 yards long, 40′ deep after partial filling, and 60′ wide. This entire cut seems to be made in alluvial earth or transported matter, at least the portion now visible has such material for its walls. The principal amount of ore taken last out of this bank, is said to have been obtained near the N. E. end of this cut, from a shaft 75′ deep, that was sunk from the bottom of the cut. It is said that from this shaft a drift was run to the S. W. in a mass of ore 40′ wide. At the N. E. end of the cut a considerable mass of lean shaly ore is visible in the ledge. This is material left as being too poor to move. The ledge has the usual concentric structure, and is composed of shells or sheets of shaly or argillaceous ore more or less consolidated together and enclosing clay, much as was seen at Mt. Torrey and Bare bank. The shells are made up in part of concretions pressed together. A mixed mass of clay and shaly ore is here shown 30′ wide. This appears to represent a portion of the outcrop of ore. It is composed of several ledges of the shaly ore with bands of clay between, that represent the excavations from which good ore was once taken out, and which are now filled up. The best ore lying around the excavations, such as was selected for use, is a good, solid, light, to chestnut brown, hematite, which appears to be comparatively free from earthy and other impurities, and is of the same kind with the best of the Bare bank ore. It shows an analysis of 48 per cent of metallic iron.

Kaolin Deposits at Black Rock.—The ore deposits at Black Rock lie farther than usual in front of the Potsdam quartzites, being perhaps as much as ½ a mile to the N. W. of the quartzite mountain. The space between the ore deposits and the mountain is gently undulating, and rises gradually towards the mountain. Its surface near the ore deposits is alluvial, and covered with float stones and drift. With the float matter some fragments of Psilomelane are to be found. Under the immediate surface is a deposit of yellowish, often sandy clay, and under this comes in places a deposit of kaolin, something like that at Porcelain. Pits have been dug here and there in this clay, that expose, as is claimed, an immense body of the kaolin. I examined some of these pits, and found that they indicate that the kaolin is irregularly distributed, for in some the entire depth of the pit is dug in the kaolin, while a pit a few hundred feet off may show none at all. One of these pits 20′ deep shows the kaolin from the surface to the bottom. It is, however, not all pure enough to work, being mixed with colored clay in portions of the mass. The best of this kaolin is pure white, very fine, and plastic, and is, no doubt, a valuable material. As there was no one interested in the property present to show me the developments, and only interested parties would take the trouble to show the properties, I had but a limited

opportunity to examine this kaolin, and it is quite probable that I did not see the best and largest deposits. I am quite satisfied, however, that the probabilities are in favor of a very large amount of good clay here. Good kaolin is said to have been found in the Black Rock ore bed. Particles of this clay still remain on the surface, and indicate a very pure fine and plastic material. The locality is well worthy of attention. Good sites for the erection of manufactories exist at many points.

McCormick or Fine Ore Bank.—This bank is practically the extension of the Black Rock to the S. W., for it is found a few hundred yards off from the Black Rock. The name Fine ore comes from the fact that a good deal of the ore was in the form of small lumps and particles, imbedded in the clay. The workings here seem to have been extensive, chiefly in the form of open cuts and pits. The ore has a fine reputation for the excellence of the iron made from it. It seems to have been of the same general character with the Black Rock ore. The analysis shows 31 per cent of metallic iron, .02 per cent of sulphur, and no phosphorus. This was a specimen of lean ore.

Fauber Manganese Deposits.—The land of Mr. Fauber joins the Black Rock tract on the S. W. On this property there are indications of iron, but little attention has been paid to it, the manganese having attracted all the efforts at development. The manganese occurs as Psilomelane in nodular masses and lumps in clay. Sibert in 1859, is said to have obtained 75 tons of ore from one nodular mass. The deposits are at present being sought for by parties from Ohio who have bought the mineral rights. At the time of my visit they had made a number of small pits here and there, feeling for ore, but had succeeded only in finding a small amount of transported lumps. The trouble with the manganese of this belt is that there are rarely any trustworthy indications that can be followed as a guide in looking for the deposits, and nothing short of an actual outcrop of a large mass will show that the ore is anything more than drift or transported material.

Kelley Bank.—The Kelley bank is the last of the ore deposits of this immediate vicinity, lying in front of the Potsdam mountains, that has received any development. Good indications of ore are said to exist in the Ferriferous shales between the Fauber tract and the Kelley bank, but they have not been tested. The Kelley ore lies near the entrance to Dogwood hollow, a little S. W. of the stream flowing out of that hollow, and on the N. W. face of Cold Short mountain. The ore differs from that of Black Rock, Fine ore, &c., banks in containing, at least a large portion of it, a good deal of manganese mixed with the iron ore. In this respect it resembles the more southerly of the deposits on the Kennedy property, and seems to belong to the manganiferous band. The manganiferous ores generally, but perhaps not always, come nearer to the Potsdam quartzite than the ore that is free from manganese. This is illustrated at the Kelley bank, which is but a short distance from the quartzite. Some of the ore obtained from the Kelley bank is a solid light to dark brown material that is free from manganese, but a good deal of it is composed of iron and manganese mixed, the manganese forming layers and films in the iron. In some cases the ore is nearly pure Psilomelane. The Kelley bank was worked largely by open cuts, but the later workings were by tunnels and drifts. One of these tunnels is still open and accessible. It shows at its termination a mass of nodular ore, about 6' thick, imbedded in clay. As is usually the case when the iron and manganese are visibly mixed, the iron ore is often bright red in color, and the mixed ore has a shaly or argillaceous appearance and is not so hard and solid as the pure hematite.

(To be continued.)

Notes on the Geology of the Virginias.

Extracts from the manuscript Note Books of the Virginia Survey of 1835-41 by Prof. William B. Rogers.

(Continued from page 39.)

Formation No. X—the Vespertine sandstone and coal of the 1st and the Pocono sandstone of the 2nd Pa. Geological survey; the 13 a., Montgomery, Va., Grits and Coal Measures of the Lower Carboniferous (or Lower Sub-Carboniferous) group of Rogers' recent table of Va. formations, is described in Prof. Rogers' notes on the Virginia survey as follows:

"Formation No. X is made up of conglomerate, sandstone and slate. It contains the first coal found in the great secondary series.

There is an abrupt passage from the rocks of IX to those of this formation. The lowermost beds are, in the S. E. development of the Apalachians, highly conglomeritic—and not unfrequently purely so—of white smoothly rounded pebbles. These strata are also massive and of compact texture. They are almost purely silicious even when not conglomeritic. Along their most N. W. development this division of the formation is less conglomeritic; less in thickness—more than half less; less purely silicious and less compact.

Succeeding to the above by an abrupt transition are strata of slabby sand-rock—slightly conglomeretic at first. These beds are of rather coarse sand with considerable alumina and are noted for a want of compactness rather than otherwise. With these is a little slate with which iron ore is generally associated in small quantities.

The above passes into a slate which contains coal. This slate in immediate connection with the coal is black; a little distance removed, it is of a dark green color and soon passes into thin beds of sandstone on either side of the coal.

The upper division consists of slabby sandstone with some heavier beds that are somewhat conglomeritic. This part of the formation is generally remarkable for the quantity of vegetable impressions which its beds contain.

I have never measured the thickness of this deposit except at one locality on the flank of the Front Ridge Alleghany mountain, where it measures about 300 feet. I think its greatest thickness must be in its S. E. development where it is, at least, about 1000 feet. I would divide this measurement as follows:

To the first, or lower, division	150 to 200	ft.
To the second division	450 to 500	ft.
To the third division	50 to ...	ft.
To the fourth, or upper, division	250 to ...	ft.
Total thickness of No. X	900 to 1,000	ft.

In the slate division of this formation are two or three thin seams of coal, amounting in all to about 18 or 20 inches of coal. I think this is a large estimate of the quantity of coal; and this occurs only when the formation has the most extensive development.

This deposit as we trace it S. W., maintains its thickness very well until we get S. W. of Wythe county. From that county it gradually diminishes as we approach Cumberland Gap. At that place it cannot be recognized, and it is not deserving of a name in the upper end of Powell valley. But at the S. E. base of Clinch mountain, where that range cuts the Tennessee line, it is of some importance, showing great uniformity in the difference of the S. E. and N. W. developments.

I think I have not observed any fossils in this formation but vegetable, and these are abundant in connection with the coal and above it.

Formation No. XI--the Umbral limestone and shales of the 1st and the Mauch Chunk red shales of the 2nd Pa. Geol. survey; the 13 b., Greenbrier limestone (Carboniferous limestone) and shales of the Middle Carboniferous (Lower Sub-Carboniferous) group of Rogers' recent table of formations —is described in Prof. W. B. Rogers' notes as follows:

"Formation No. XI is formed of shales, limestone and sandstone, the first predominating. This formation bears a close resemblance to No. IX in many respects, particularly in the quantity of deep red coloring matter and in the texture of the slate and some of the heavier strata.

The formation which precedes this, we have observed, is of a very silicious character; this is remarkable for its aluminous character, particularly so in the middle and northeast portions of the Apalachians.

Immediately upon the last member of No. X we have a deep red or yellowish brown aluminous slate. This is of a character to contrast greatly with the rock which precedes it. It is but a thin band generally, and always is present to separate the limestone from the coarse rock below. The bed of limestone which succeeds is about 50 feet in thickness. It is very slightly silicious, but much of it is very aluminous. The interior of the bed presents a comparatively pure aspect.

Succeeding to the limestone is a band of slates and sandstone,—all very aluminous compared with sandstone and slate generally. It is about 300 feet in thickness, according to the estimation of the judgment. Immediately above the limestone are strata of red sandstone of considerable thickness; above this is a thinner band of light gray sandstone; that is followed by red, to which succeeds slate, interrupted occasionally by thin beds of very aluminous sand-beds, all of a deep red color. Another thin bed of limestone is now presented, of about 20 ft. in thickness. This is nearly of the same character as the preceding, with this addition, that it is more fossiliferous. Immediately above the limestone are soft red shales interrupted by thin compact beds of a more arenaceous material, and this material increases as we ascend in the formation. Arenaceous rock greatly predominates in the upper portion. These sandy beds lose much of the red coloring matter of the rocks below them if not entirely devoid of it. They are carbonaceous and contain numerous vegetable impressions, the originals of which appear, from the small portion of coal present, to have been converted into good coal. This member of the formation included between the upper bed of limestone and the upper stratum of the formation is probably between 600 and 700 feet in thickness.

Such is the appearance of this formation in the N. E., as exhibited in the Front Ridge of Alleghany mountain. In the middle and S. W. Apalachian districts great modifications are presented, as will appear below.

In the counties of Monroe, Greenbrier, Mercer, etc., No. XI has the following development:

First a thin band of fissile parti-colored very aluminous slate. Above this slate is an extensive deposit of limestone. This the calcareous portion of the deposit measures from 1,500 to 2,000 feet in thickness. This limestone is generally aluminous and its continuity frequently interrupted by thin beds of slate. These interruptions are more frequent and heavier in the upper than in the lower portion. This limestone is more massive and purer in the lower portion of the middle part than in any other. It is more fossiliferous in this part also. Magnesian limestone does not often occur in this deposit, and when this variety does occur, it is only slightly magnesian.

Above the limestone are calcareous shales which form a band of about 250 feet in thickness. These vary in character as we proceed from the lower to the upper portion. In the inferior part they are highly calcareous and fossiliferous also. In the upper part there is a passage into sandstone. The general character of the shales is fissile and soft. It sometimes occurs that beds of sandstone interrupt at intervals the continuity throughout. This part of the formation is mostly of a dark green color with sometimes a yellowish tinge.

The next member is a thin band of sandstone with a slightly aluminous character. The sand is generally coarse and the beds not very compact. These beds are of considerable thickness and have a yellowish gray color sometimes tinged with brown; the degree of compactness varies,—sometimes it is small and at other times the reverse. Near the great falls in New river these beds are vitreous. The thickness of this division is probably about 50 feet.

The succeeding variety consists of red and other colored shales alternating with thin beds of brown and brownish gray sandstone. The sandstone predominates in the lower part while the shales prevail in the upper. This member is about 200 feet in thickness and is terminated by a very thin bed of limestone which is generally highly fossiliferous.

There is now a band of heavy brown sandstone varying from 30 to 50 feet in thickness and composed of rather coarse sand not very much compacted together. A dark colored slate succeeds to this which is terminated by slate of a red color that passes into brown sandstone. Soon after this last exposure we get upon the conglomeritic platform of the great coal formation.

In the extreme S. W. we have still another modification, and this formation is made up as follows:

First a thin bed of soft shales that precede the limestone; then the limestone, purer and more massive than in the middle part above described, and here diminished to about one-fourth the thickness it measures there, which is 1,675 feet.

To the limestone succeeds slate, heavier and more silicious than in the middle Apalachians, terminated by a heavy band of vitreous sandstone exceedingly compact and of a light gray color.

Dark colored slates and slate rock come next, and these are succeeded by a heavy band of sandstone, slightly conglomeritic, which I supposed was the commencement of No. XII; for in the slate above it is a thin bed of coal."

Measurements of sections of No. XI were made at various points, by Prof. Rogers and assistants, as follows:

1. In Front Ridge Alleghany Mn., W. Va.

1. Deep red and yellowish brown argillaceous slate or shale, generally in small amount.....
2. Limestone, argillaceous and silicious, about..... 50′
3. Highly argillaceous slates and sandstones, deep red. About.. 300′
4. Limestone, more fossiliferous than preceding..... 20′
5. Soft red shales with occasional bands of sandstone. The sandy strata become more frequent as we ascend and greatly predominate above, at the same time losing much of the red color and often presenting large masses of gray sandstone.—Many vegetable impressions, in the upper parts converted into coa, Lepidodrenda, etc. Thickness from....600′ to 700′, measured from 4 to the base of the conglomerate.

This makes XI at that point from 970′ to 1,070′ thick.

2. On Greenbrier Mn., W. Va.

1. Red, green and partly colored shale..... ... .
2. Great mass of argillaceous limestone with interposed yellowish and ashy shale,—all full of fossils Nearly..... 2,000′
3. Colored shales passing upwards into argillaceous sandstone.—About..... 250′
4. Yellowish gray coarse sandstone. About..... 50′
5. Brownish argillaceous sandstone, alternating with and followed by red and party colored shales.—About..... 200′
6. Thin bed of highly fossiliferous limestone.....
7. A large thickness of brownish sandstones and slates and red shaly slates and grayish sandstones..... ....

3. In S. W. Virginia.

1. Red and greenish and drab shales.....
2. Limestone, much of it massive and pure, but on the whole argillaceous.....500′ to 600′
3. Calcareous slate and flaggy rock..... 125′
4. Thin bedded sandstone and slate.....425′
5. Calcareous slates with a few thin layers of limestone..... 75′
6. Massive vitreous sandstone..... 125′
7. Dark brownish slates and flaggy sandstones..... 425′

This makes a section 1,675′ to 1,775′ thick.

Virginia Gypsum.—In the recently issued report of Mr. A. S. McCreath on the mineral resources of Virginia along the Shenandoah Valley and Norfolk & Western railroads, is the following notice of the gypsum of S. W. Va. The Editor is in receipt of a letter from Prof. N. A. Pratt, state chemist of Georgia, Atlanta, Ga., asking the address of parties mining and shiping a pure article of gypsum, as friends of his wish to procure it by the car load. We hope this Va. article may suit him; it is on the great freight line from Virginia to the South.

"In Smyth and Washington counties of south-west Virginia, large quantities of gypsum are annually mined, the principal developments being in the neighborhood of Saltville. The deposits have been examined at different times by geologists, and all agree that the quantity must be very great.

Gypsum, in its natural state, is a compound of sulphuric acid and lime, with two equivalents of chemically combined water; and it has the following composition in one hundred parts:

Lime	32.56	100.00
Sulphuric acid	46.51	
Water	20.93	

When heated to 272° F. the mineral loses its water, and it is then known as *Plaster of Paris*, which is extensively used in making casts and cornices.

The value of gypsum in agriculture has been the subject of a great diversity of opinion—rather more with reference to the way in which it acts than on account of any doubt as to the beneficial results which follow its proper use. Liebig, the great agricultural chemist, says that 'The evident influence of gypsum upon the growth of grasses, the striking fertility and luxuriance of a meadow on which it is strewn, depends, *in some degree*, upon its fixing in the soil the ammonia of the atmosphere which would otherwise be volatilized with the water which evaporates.'

It has been applied both directly as a fertilizer and indirectly in compost with ammoniacal and other manures. In each case the result has been beneficial, both by the direct supply of its own material for the nourishment of plants and by its influence upon the volatile carbonate of ammonia, whether in rain water or manure, as already mentioned above.

While good results have been obtained on numerous crops, yet it has been found to be specially valuable for clover and grasses. The existence of large deposits of this valuable mineral will doubtless become of immense importance to the agricultural interests of Virginia when its true value becomes better known and more widely appreciated.

The quality of the gypsum is unusually fine, as shown by the analysis of samples selected by Mr. Thomas Jones from the plaster banks of the Salt Works Co., at Saltville, Washington county:—

Lime	32.293	99.964
Magnesia	.151	
Oxide of iron and alumina	.149	
Sulphuric acid	46.445	
Water	20.856	
Silicious matter	.070	

Coal and Coke Traffic of Ches. & Ohio Ry., March, 1883.

General Manager C. W. Smith sends *The Virginias* the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during March, 1883, and March 1882, in tons of 2000 lbs., compiled by fuel agent C. M. Gibson.—The following are the March returns:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	3,554	3,433	121	.....
Gas	29,840	29,420	420	.....
Splint and block	6,083	14,632	.....	8,549
New River, &c	38,884	25,735	13,149	.....
Coke	12,026	7,948	4,078	.....
Totals	90,387	81,168	17,768	8,549

This shows a net increase of 9,212 tons, or a little over 11 per cent, in March 1883 over March 1882. A reference to page 34 will show that the February gain was also 11 per cent; so the traffic is holding its own.—The increase in Mar. over Feb. was in the movement of Kanawha gas and New River coking and steam coals, the former gaining nearly 12 per cent and the latter over 13; the gain in the coke traffic for same time was also over 13 per cent.

The distribution of the above was as follows:

	1883	1882.
1. To C. & O. Co. for its own use	18,200	14,666
2. To Huntington, for West via Ohio river	871	7,479
3. On Elizabethtown, Lexington & Big Sandy RR.	4,358	4,917
4. On Ches. & Ohio Ry., excepting Richmond	17,209	12,283
5. To Richmond & Alleghany RR. at Clifton Forge	1,509	1,637
6. To Valley RR. of Baltimore & Ohio at Staunton	34	17
7. To Shenandoah Valley RR. at Waynesboro	7	593
8. To. Va. Midland Ry. At Charlottesville	5,542	934
8. To. Va. Midland Ry. At Gordonsville	.....	29
9. To Richm'd, Fredericksb'g & Potomac RR, at Junc	232	435
10. To Richmond for consumption, including tugs, &c.	11,770	11,320
11. To James R. wharves for shipment	5,221	26,858
12. To Newport News For consumption including tugs, &c.	189	.....
12. To Newport News For shipment	25,245	.....
Totals	90,387	81,168

The interesting features of this distribution are: The increased consumption by the C. & O., showing an increase of business on that railway; the largely decreased shipments from Huntington for down the Ohio, (not because of any decrease in the river coal trade from the Kanawha region, but a consequence of largely increased shipments by water directly from the mines); the large increase in deliveries along the line of Ches. & Ohio, mainly a result of preparations for starting the new Victoria furnace; and the continuance of large shipments at Newport News.

The following table presents the progressive traffic from January 1 to March 31, inclusive, for 1883 and 1882.

Kind.	1883.	1882	Increase.	Decrease.
Cannel	8,264	6,309	1,955	.....
Gas	81,134	67,128	14,006	.....
Splint and block	29,131	43,792	.....	14,661
New River, &c	105,322	79,335	24,987	.....
Coke	31,468	25,968	5,500	.....
	254,319	222,532	46,448	14,661

The above shows a net gain of 31,787 tons, or over 14 per cent, in the C. & O. fuel movement for the first quarter of this year (the months of Jan., Feb. and March, 1883,) over the same quarter of 1882. The increase is mainly in Kanawha gas and New River coking and steam coals, especially the latter; the increase in the coke and cannel traffic is a good one. The only decrease is in Kanawha splint and block coals; these go chiefly to western markets, where they are preferred, and now mainly by water. as stated above.

Judging the movement for 1883 by this first quarter of the year, it will be 1,016,876 tons; the gains indicated will raise the quantity to at least 1,250,000.

The West Virginia University Class in Geology, in charge of Prof. I. C. White—one of the best of our American field geologists, as his volumes on the Pennsylvania survey and his papers in *The Virginias* attest,—will start on its annual geological tour May 3rd. The route selected for observation and exploration is:—Down the Ohio, in a boat, from Wheeling to Point Pleasant (Great Kanawha-mouth), ascertaining the geological facts along the Ohio, of which we have no definite knowledge as yet; then up the Great Kanawha, spending a week in studying its vast coal field, concerning which *definite continuous information* is badly needed just now when new railway lines are entering it and old ones are seeking to develop it by extending branches to where its best coal beds are most accessible. From the Kanawha field it is proposed to go to Richmond, Va., by the Chesapeake & Ohio and Richmond & Alleghany railways, examining the grand geological sections and great iron ore mines along those roads, then return by way of Chesapeake & Ohio Ry. to Waynesboro, the Shenandoah Valley R. R. to Shenandoah Junction, stopping at the Luray caverns, at iron ore beds, limestone quarries, &c., and back to the University by way of the Baltimore & Ohio.

Prof. White and his students make a party of a round dozen, and we question whether any portion of the Union can match these sturdy West Virginia mountain boys (The Prof. himself is a West Virginian and will always be a boy in enthusiasm in his professional science) in muchsomeness of all things that enter into the make up of manly men.—We bespeak for them the greetings and hospitality that such young men on such a mission are fairly entitled to. Our readers will have from Prof. White some of the "results" of this tour.

The William B. Rogers volume that is now passing through the press of D. Appleton & Co., New York, is a reprint from the original editions of his annual reports and other papers on the geology of Virginia, (including West Virginia.) The following is a list of the papers that will appear in this volume; they are arranged in the order in which they were prepared or made public.

1. The Tertiary Marl Region of Virginia, 1834.
2. Report of a Geological Reconnoissance of Virginia, 1835.
3. Report of Progress of Geological Survey of Virginia, 1836.
4. Report of Progress of Geological Survey of Virginia, 1837.
5. Report of Progress of Geological Survey of Virginia, 1838.
6. Report of Progress of Geological Survey of Virginia, 1839.
7. Report of Progress of Geological Survey of Virginia, 1840.
8. Report of Progress of Geological Survey of Virginia, 1841.
9. Analyses of Waters of Mineral Springs of Virginia.
10. The Temperature of Virginia Springs.
11. Observations on Subterranean Temperature in Mines of Eastern Virginia, 1842.
12. The Connection of Thermal Springs in Virginia with Anticlinal Axes and Faults, 1842.
13. The Structure of the Apalachian Chain, 1842.
14. The Age of the Coal Rocks of Eastern Virginia, 1842.
15. Report on Pridevale Coal and Iron Lands, W. Va.
16. On Gravel and Cobble-stone Deposits of Virginia, etc., 1875.
17. Notes from Macfarlane's Geological Railway Guide.
18. Artesian Borings at Fort Monroe, 1882.
19. Glossary.

The Changes of a Century in Virginian Orthography are well represented by comparing the spelling of names and words by Jefferson, one of the most scholarly and particular men of his time, in his "Notes on Virginia," published in 1781, with the present usage as shown in the following lists; that of Jefferson under the heading 1781, and the present usage under 1881. Some substitutions of other names are included.

1. *Virginian Geographical Names.*

1781.	1881.	1781.	1881.
Accomak,	Accomac.	James' River,	James River.
Alleghaney,	Alleghany	James' town }	
Apalachian	Appalachian.	James-town, }	Jamestown.
Berkley, }		Kittatinney,	Kittatinny.
Berkely, }	Berkeley.	Lynch's ferry,	Lynchburg.
Bull-pasture,	Bull Pasture.	Lynhaven,	Lynnhaven.
Brunswic,	Brunswick.	Le Tarte's,	Letart.
Chesapeak,	Chesapeake	Mattapony,	Mattaponi
Cow-pasture,	Cow Pasture	Matchodic,	Machodoc
Calf-pasture,	Calf Pasture.	Mecklinburg,	Mecklenburg.
Corotoman,		Nomony,	Nomini.
Charlottsville,	Charlottesville.	Nansamond,	Nansemond.
Culpepper, }		Neapsco,	Neabsco.
Culpeper, }	Culpeper.	Petersburgh,	Petersburg.
Elisabeth City }		Pamunkey,	Pamunky.
Elizabeth City }	Elizabeth.	Portroyal,	Port Royal.
Frederic,	Frederick.	Patowmac,	Potomac.
Faquier, }		Rocket's,	Rocketts.
Fauquier, }	Fauquier,	Rappahannoc,	Rappahannock.
Great Kanhaway	Great Kanawha.	Shenando, }	
Green Briar, }		Shandoah, }	Shenandoah.
Greenbriar, }	Greenbrier.	South West Mn.	Southwest.
Guiandot,	Guyandotte.	Shawanee, }	
Great Sandy,	Big Sandy.	Shawanese }	Shawnee.
Hard-ware,	Hardware	Wicocomic,	Wicomico.
Hampton road,	Hampton Roads.	York town,	Yorktown,
Halooing point,		Yohoganey,	Youghiogheny.

2. *Other American Geographical Names.*

Arkanzas,	Arkansas.	Mjssisippi,	Mississippi
Big Bones,	Big Bone Lick.	Mohaws River,	Mohawk River.
Chickamogga,	Chickamauga.	Ouisconsin,	Wisconsin.
Chickago,	Chicago.	Oubache,	Wabash.
Cayahoga,	Cuyahoga	Patuxen,	Patuxent.
Chelicothe,	Chillicothe.	Pancore }	
Fort Pitt,	Pittsburgh.	St. Louis }	St. Louis.
Gulph of Mexico,	Gulf of Mexico.	Sioto,	Scioto.
Groenland,	Greenland.	St. Laurence,	St. Lawrence.
Hudson's River,	Hudson River.	Tanissee River }	
Hock Hocking	Hockhocking.	Cherokee " }	Tennessee.
Lake Erie',	Lake Erie.	Hogohage " }	
Log's Town,	Logstown.		

3. *Orthography of Common Words.*

A-fire,	afire.	Maize,	corn.
Arrises,	arises	Marle,	marl.
Bason,	basin.	Marten,	martin.
Buck wheat,	buckwheat.	Negociation,	negotiation
Banjar.	banjo.	Oranooton,	orang-outang.
Chesnut,	chestnut.	Pit-coal,	coal or stone c.
Blue gross beak,	grosbeak.	Punkins,	pumpkins.
Buck's-eye,	buckeye.	Papaw,	pawpaw.
Beach,	beech.	Perroquet,	parroquet.
Clymings,	cymlings.	Potatoe,	potato.
Cuckow,	cuckoo.	Peccan.	pecan.
Cloath,	cloth.	Plumb,	plum.
Chuse	choose.	Round potatoes,	sweet potatoes.
Eye-draught,	draft.	Reaumur,	Reaumer.
Expence,	expense.	Sumack,	sumac.
Farenheit,	Fahrenheit.	Shew,	show.
Greensword,	greensward.	Spheroidical,	spheroidal.
Hiccory,	hickory.	Soree, }	
Horse-chesnut,	horse chestnut.	Ral-bird }	sora.
Head-ache,	headache.	Sheldrach }	
Ground-nuts,	peanuts.	Canvas back, }	canvass back.
Inarable,	not arable.	Sea-coast,	sea coast.
Ingenius,	ingenious.	Slate-stone,	slate.
Jasmine,	jessamine.	Syphon,	siphon.
Lime-stone,	limestone.	Tythes,	tithes.
Long potatoes,	Irish potatoes.	Tomatas,	tomatoes.
Mill-stone,	millstone.	Vallies,	valleys.
Mallow,	mallows.	Waggon,	wagon
Musk-melon,	muskmelon,	Whip poor Will,	whippoor will

The Rorer Iron Co. has commenced laying steel rails on its narrow-gauge railroad,leading from the Norfolk & Western and Shenandoah Valley railways, at Roanoke, Va., to its mines at Gale, about 5 miles south of Roanoke, and early in May it will commence the shipment of brown hematite ores to Ironton, Ohio, and other points where large contracts for these excellent ores have been placed. Over 1,500 tons of ore are now mined and ready for shipment and mining operations are being vigorously pressed in three large open cuts.—The officers of this company are: Ferdinand Rorer president, and John H. Sykes treasurer, Roanoke, Va.; Samuel Coit vice-president, Hartford, Conn.; George N. Gray sales agent, Ironton, Ohio; and W. A. Westcott superintendent and general manager, both of mines and railway, Gale, Roanoke Co., Va.

This company has graded about 6 miles of railway, including switches; purchased 300 tons of 30-lbs steel rails; purchased a 3'-gauge H. K Porter & Co. saddle-tank locomotive, 9½ by 16 cylinder, 6 wheels, 800 tons capacity; bought 17 freight cars, 5 tons capacity, of the Ensign Mfg. Co., Huntington, W. Va.,; constructed ore-pockets to hold 500 tons; opened its mines and piled up ready for shipment, over 1500 tons of ore; constructed buildings at mines, and paid $5,000 for rights of way,—and yet its expenditures have been less than $50,000.—From what we can learn we should judge that its mines and railway will be put in good working order and fully ready to ship regularly from 200 to 250 tons of ore a day, for about $50,000. This shows how cheaply preparations can be made in the Virginias for extensive mining operations, when energy and economy of management are at the helm. Its railway will move ore from other mines for regular freight rates.

The Virginia China Clay and Fire Brick Co. has been chartered, by the state of West Virginia, with a capital of $75,000. This company will own, improve and operate the "Porcelain" property, on the line of the Shenandoah Valley RR., near Sherando station, Augusta county, Va.,—the kaolin beds of which were described by Prof. Fontaine on page 47 of No. 39 of *The Virginias*. Messrs. Sweeney and Walton, of Wheeling, W. Va., who purchased this property a few months ago, have had samples from the large deposit of kaolin at Porcelain made into white ware, tested as fire-clay for fire-bricks, etc. The ware made from it is of a very fine quality, equal to the best imported, judging by the samples they have shown us and the testimonials of manufacturers; its color is very rich and clear and there is no question but that it will be eagerly sought for when put upon the markets. A crude brick made from it and subjected to a high heat alongside one of the noted Mt. Savage fire-bricks, came through the ordeal but little changed, while its rival was badly damaged. Glass pots made from it proved better than any now in use.

We learn that a number of prominent Wheeling men have taken stock in this company. We hope it will soon have all its stock taken and get to work making fire-brick.—Contracts have already been made for its fine china-clay at East Liverpool, Ohio.

The Fayette Coal and Coke Co., Stone Cliff, Fayette co., W. Va., on Ches. & Ohio Ry., N. M. Jenkins, superintendent, now calls the excellent Lower measures or New River coal that it mines "Big Bend steam coal," from the big bend of New river on which its mines and coke works are located. We are in receipt of samples of the superior New River coke made at these works.—Lenox Smith is president and Russell F. Webb secretary and treasurer of this company, with offices at 20 Nassau st., New York.

Am. Institute of Mining Engineers.—The programe for the Roanoke, Va., meeting, so far as it has been made out to this date, is as follows:

Tuesday, June 5th, 8 P. M., opening meeting, address of welcome, etc., at Roanoke, Va.

Wednesday, June 6th, excursions to Roanoke Car and Machine Works, Crozer Furnace, Gale, Houston and Upland iron mines,—places at and around Roanoke.

Thursday, June 7th, excursion by the Norfolk & Western RR. to Flat-top coal field and coal mines of S. W. Va. Improvement Co., at Pocahontas, to iron mine of same Co., at Ripplemead, and to Bertha Zinc Works at Martin, reaching Wytheville for the night.

Friday, June 8th, excursion to Cranberry iron mines, on border of N. C., by N. & W. RR. and return to Roanoke or Lynchburg.

Saturday, June 9th, excursion to Norfolk by N. & W. RR. and inspection of harbor of that city and terminal facilities of N. & W.

The Kanawha RR. Co., the one owning the railway up Cabin creek from Coalburg station of Ches. & Ohio Ry. and the Great Kanawha river; has fixed upon the following rates of transportation per 2240 lbs ton of coal:

For 4 miles or less, 15 cents; for between 4 and 5 miles, 16 cents; for between 5 and 6 ms., 17½ cts.; for between 6 and 7 ms., 19 cts; and for between 7 and 8 ms., 20 cts.—This includes carriage over railway and dumping into barges over tipple, but does not include the handling and triming of the barges.

This road is certain to become one of the most important short lines in the Great Kanawha coal basin, especially when extended a few miles farther up Cabin creek to some beds of superior gas coal found there, one of them furnishing a coal containing 38.97 per cent of volatile matter and but 2.93 of ash.

Successful iron ore mining.—Mr. Henry Body of Clifton Forge, Va., one of the most industrious and successful of our mining men, mined during the month of March, 1883: from the Arcadia mines 1,000 tons, from the Big Hill mines 500 tons and from the Clifton Forge mines 600 tons, or 2100 tons in all. Of this ore he shiped to Quinnimont furnace, W. Va., by Richmond & Alleghany and Chesapeake & Ohio railways, 600 tons from Arcadia, 300 from Big Hill and 500 from Clifton Forge.—It gives a good idea of the greatly varied character of our iron ore resources when the fact is stated that the three mines above mentioned are all on the line of the Richmond & Alleghany RR. in a north and south direction of 30 miles, and that they are in three different geological formations, Arcadia in Rogers' No. I, the Potsdam, Big Hill in No. VII, the Oriskany, and Clifton Forge in No. V, the Clinton formation.

The Eagle mine, at Eagle, Fayette co., W. Va., Wm. Wyant proprietor,made an output of 54,874 tons of coal in 1882; is now putting out about 5,000 tons a month and its proprietor hopes to mine 70,000 tons this year.—The slack from this mine is being converted into excellent coke, samples of which have been sent us for testing and analysis.

The St. Clair Co. is now putting out 50 tons of coal a day; it makes a good coke from the "run of the mine" coal, samples of which have been sent us for analysis and testing.

Beech for charcoal.—We find in the April No. of the Journal of U. S. Charcoal Iron Workers, page 102, the following interesting communication from Bernhard E. Fernow, consulting forest engineer, Slatington, Pa., on our beech timber for charcoal. Mr. B. has made a very valuable report on the forests of a portion of W. Va., so a statement from him is based on actual observations.—The editor of the journal from which we quote questions some of Mr. Fernow's conclusions.

"When prospecting through West Virginia last fall, the writer found that the beech (*Fagus ferruginea*) formed no inconsiderable portion of the woodlands; and that there, as in other localities, this tree is considered of inferior value, and is hardly used even for fuel. This was the more astonishing, as in Germany the same beech vies among the forest trees for the second place in utility and value, the oak of course taking the first and the pine (Scotch) ranking about even in significance with the beech. In fuel value the latter is considered second only to the oak, and for special uses, as mining timber, for wagon-stock, for wooden ware (especially odorless butter tubs) and for many other manufactures it is second to none.

As it will become necessary in time in this country too, to study the capabilities of each tree species for different purposes, in order to decide upon the choice of those species, from the many, which will best repay the planter or best suit his purposes, the following notes on the beech as a charcoal producer, published in a recent German forestry journal, will be acceptable.

As the construction and use of Mathieu's retorts, in connection with iron works, seem to find favor and the interest of charcoal iron-workers is thus drawn into the line of chemical works, it may be of interest briefly to describe the retorts in use for ten years at Fredericksbutte in Hesse, for the purpose of making wood vinegar; the charcoal resulting from the process being used in the furnace.

The retorts are simply boiler-like iron cylinders three feet in diameter and nine feet long, horizontally placed in ovens like common flue-boilers. In front is the door for charging, at the back the opening for the gases to escape into the condenser. Each cylinder contains a basket made of iron bars, for the purpose of quickly withdrawing the charcoal into an iron box, which, to effect gradual cooling, is covered with a lid made air-tight by the use of clay. There are 24 retorts in use, which produce yearly at least 1,200 tons of beech charcoal. The wood used is made three feet long, and all dimensions, even stocks and roots are used—the latter give the same quantity of distillates, but require longer time for charing than the ordinary cord-wood. Each retort is charged with about one-half cord of split wood. Duration of process, 18 to 20 hours, (formerly 12 to 14 hours, with less favorable results.) Temperature about 250° C, (482° F.) The cooling requires five hours. Each two retorts have one fireplace; coal, saw-dust saturated with tar, and also the gases resulting from the process, which cannot be condensed, are used for firing.

One cord of beech-wood weighed 4,092 pounds, and yielded, in the average, 966 pounds of good charcoal, or 23.6 per cent in weight, the small braize not included. And since one bushel, (of 2,748 cubic inches) of coal weighed 20.38 pounds, one cord yielded 47.39 bushels. In the coalings in meilers the average result obtained in the same district, and with the same wood, was 41.3 bushels per cord, or 1,094 pounds, which brings the weight of the bushel to 26.5 pounds, (braize included.) These comparative results, extending over a number of years, confirm that the specific weight of charcoal made in retorts is very much below that made in meilers, whilst the yield in volume is in favor of the retort.

The charcoal made of beech is a superior fuel for iron-smelting; it was found that the working of the blast-furnace was more regular with the distilled coal than with that from the meiler, but to obtain the same results a greater volume of the former was necessary, which is easily explained by the difference in weight.

In conclusion, it may be interesting to know that several thousand tons of beech charcoal are used annually in the distilleries of Europe, for the removal of the fusil oils, etc., as it forms a most excellent filter.

Geographical Notes.

The origin of the name "New River," the upper Kanawha, is involved in much obscurity. Last November (1882 Vol. p. 176), we published a letter from Maj. T. L. Broun of Charleston, W. Va., claiming that it was named "New river" by surveyor Peter Fontaine, in 1752, as it is put down on a map of that date made by him. Now we have a letter from Capt. C. R. Boyd, of Wytheville, Va., stating that Hon. David McComas of Kanawha, an eminent Virginia judge many years ago, said "that *New river* was a mere translation of the Shawnee term *Kanawha*, which means *New water*, as Minnehaha in an allied dialect means Laughing water."—Capt. Boyd suggests that Judge McComas derived his information from the elder Gov. Floyd who derived it from the Indians themselves. Our antiquarian friend, Dr. J. P. Hale, of Charleston, W. Va., who has been investigating this question very diligently, claims that it was named "the New river," long before Fontaine's time, by Abram Wood, who discovered it by crossing the Blue Ridge at what is now known, from him, as Wood's gap and coming down Little river of Montgomery county to it. To substantiate his position Dr. Hale cites old maps on which it is called "Woods river" after Abram Wood, and claims that the common statement that the word "Kanawha" means "the river of the woods" is a mere jump at a conclusion by some one that saw it named Woods river on an old map. Atkinson in his history of Kanawha county, p, 11, says: "In the Indian dialect 'Kenhawa' signifies 'River of the Woods."

We will merely add, now, that on Herrman's map of Virginia, 1670, no westward flowing rivers are given, but the statement is made on it that beyond the "mighty High and great Mountains trenching N. E. and S. W.," the Indians report a very great river called the "Black Mincquaas River;" Collet's map of North Carolina, 1774, has it "New River;" Jefferson's map, made in 1787 to accompany his Notes on Virginia, has only the name "Great Kanhaway" on this river; Samuel Lewis' map of Virginia, 1794, has it "Great Kanawha River" (the approved present spelling of that name). There are numerous sources from which additional information concerning the origin of this name may be obtained, and we hope to have some of it for publication.

Silver Coin has been put in a vault of the U. S. sub-treasury in New York, says a paper of that city, until 846 tons—$22,000,000 in dollars and $32,668,000 in smaller coin—are lying idle there; and then that paper proceeds to comment on what it calls the folly of coining more silver.—The "folly" lies in the fact that this coin is not sent to interior points, where it can be put in circulation; for *be it known that there is* in all the thriving and rapidly developing parts of Virginia and West Virginia—and presumably in other similarly conditioned parts of the South—*a dearth of all kinds of silver coin.* The business operations of this section are seriously interfered with by the inability of the banks to supply exactly this kind of money. Our negro laborers—the very best in the world for mining, railway construction, and all coarse and heavy manufacturing operations—prefer it in all cases. Nothing promotes thrift and economy more than an abundance of silver coin in circulation.

The Virginias.

No. 41. Vol. IV.—No. 5.

Staunton, Va., May, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

The Spelling reform that we advocate, and that we intend to practice in the publication of *The Virginias*, is one that aims at the restoration of words to their simple original forms, omiting redundant and entirely useless letters that have sneaked into use, especially in the addition of grammatical and other suffixes.

In this number, for example, the following words will be spelled in accordance with the above principle, and not as they are now generally printed, although a large number of other words, *precisely like them*, are printed in the same way. To present more clearly our view of the right method we will here separate the basal or root words from the added suffixes, and will ask the reader to divest himself of prejudices, that from use have become his ideas, and see if he can find any reason why the omited letters ought to be replaced. They do not belong to either the root-word or to the added suffix; nor have they anything to do with the pronunciation of the word,—they are simply interloping nuisances that, by the dictates of common sense and a good usage of our language, ought to be droped.

The changed words are:—omit-ing, omit-ed, drop-ed, occur-ence, spot-ed, metal-ic, imbed-ed, get-ers, occur-ing, interbed-ed, bed-ed, red-ish, outcrop-ing, permit-ed, argilaceous, etc.

McCreath's Report of Virginia Minerals is so replete with analyses of the ores, coals, etc., of Southwest Virginia, and with iron manufacturing notes, we have not deemed it necessary to furnish such information in this number, taking it for granted that his extremely valuable report will be given to each member of the Institute of Mining Engineers attending the Roanoke meeting.

The Coke Controversy that originated in a friendly discussion of the comparative merits of New River, W. Va., and Connellsville, Pa., cokes between the "Keystone Courier" and "The Virginias", and was continued in the "Courier" by Mining Engineer John Fulton of the Cambria Co., in an article that provoked a somewhat sharp criticism from Curator of Metallurgy Fred P. Dewey, of the National Museum, has taken a rather unpleasant and somewhat personal turn in a rejoinder from Mr. Fulton in the "Courier", which we reproduce on page 70, and which has in turn called forth a letter from Prof. Dewey, which appears on page 84.

We regret that our friends have let their coke get too hot. We desire to have this question of the physical structure of coke, in so far as it affects the character of that fuel for metallurgical purposes, fully and fairly discussed, that the users of coke may know whether there is any value in it; therefore we requested Prof. Dewey, who occupies the high position of Curator of Metallurgy in the National Museum, where he has all needed appliances for such investigations, to make this matter the subject of study, in the general interest of science and of our metal-workers, having the utmost confidence in his skill and integrity in this important matter. He has gone systematically and thoroughly to work, collecting cokes for experimental tests from all parts of the country, and not in the interest of any particular coke or coke region.—Let us have a peaceable discussion, gentlemen, a battle of stubborn facts based on experiment and observation.

Two new furnaces have this month gone into blast in Virginia, the great Victoria, of the Va. Iron & Steel Association, at Goshen, on Ches. & Ohio Ry., the first of the month, and that is now making regularly over 100 tons a day, and the large Crozer, of the Crozer Iron & Steel Co., at Roanoke, on Shen. Val. and N. & W., the last of the month.—It is very gratifying to record *the going into blast* of such furnaces in Virginia while so many elsewhere are *going out of blast.*—There is food for thought in such a fact.

The Woodland Fire Brick Co., of Woodland, Clearfield county, Pa, one that advertises in *The Virginias*, has favored us with a bound copy of its well gotten up and practically illustrated catalogue of fire bricks for coke ovens, lime kilns, rolling mills, heating furnaces, steel purposes, malleable iron works, blast furnaces, etc. This work is full of valuable information for all users of fire brick. Elsewhere we publish analyses of the fire clays used by this company.

Len-nik-bi is the name of the tulip-poplar (Liriodendron tulipifera) in the language of the tribe of Indians known as Delawares, states Dr. P. K. Rogers, formerly a professor in William and Mary College, Va., in a thesis on that tree.—That would be a good name to give to some railway station, one near which this magnificent tree is found in abundance, in place of repeating foreign or domestic names that have no local significance. The Delawares at one time occupied Virginia territory.

No. 5 —*N. & W. RR.: New River to Bristol.*

Stations.	County and State.	Miles from Roanoke.	Feet above Tide.
New River	Pulaski, Va	44.5	1,700.0
Dublin	" "	51.0	2,054.2
Martin	" "	58.5	1,900.6
Max Meadows	Wythe "	71.0	2,015.5
Wytheville	" "	79.0	2,239.4
Crockett	" "	86.5	
Rural Retreat	" "	92.0	2,502.9
Marion	Smyth "	106.5	2,123.5
Seven-mile Ford	" "	113.5	1,976.2
Glade Spring	Washington "	122.5	2,075.0
Emory	" "	126.5	2,084.2
Abingdon	" "	135.7	2,056.8
Goodson-Bristol	" " Va.Tenn	159.5	1,676.5

American Institute of Mining Engineers.

The Roanoke, Virginia, Meeting, June, 1883.

President R. W. Hunt and Secretary T. M. Drown, under date of May 12, 1883, have issued the following Program of the Summer Meeting of the American Institute of Mining Engineers, to be held in Virginia, begining in Roanoke, Monday evening, June 4th, 1883.

Monday, June 4th.—The Opening Session will be held in Roanoke, on Monday evening at 8 o'clock. Address of Welcome will be made by Mr Lucien H. Cocke, Mayor of Roanoke. Reading and discussion of papers.

Tuesday, June 5th.—Visit to Lynchburg by special train on the Norfolk & Western Railroad, On arrival at Lynchburg, a train, kindly provided by the Richmond & Alleghany Railroad, will take the party to the iron mines on the James river at Riverville, and, if time allows, also to Stapleton. In the evening there will be a dinner and reception given by the citizens of Lynchburg. Return to Roanoke in the evening.

Wednesday, June 6th.—Local excursions around Roanoke, visiting the Crozer Furnace, Upland and Houston mines, Rorer Iron Company's mines and the Roanoke Machine Works. Evening session.

Thursday, June 7th.—Excursion to Pocahontas (Flat-Top Coal Fields), and the Southwest Virginia Improvement Co's coal mines and coke ovens. Returning, the Ripplemead mines and Bertha Zinc Works will be visited. The night will be spent at Wytheville.

Friday, June 8th.—Excursion to the Cranberry magnetic iron ore mines in North Carolina, returning to Roanoke in the evening.

Those wishing to visit the Cripple creek ore region can do so by remaining after the close of the meeting, the Norfolk and Western Railroad having kindly extended the courtesies of the road for this purpose.

The Shenandoah Valley and the Norfolk & Western railroads have generously offered free transportation to members and the ladies of their families over their lines to and from Roanoke, and also for the excursions of the meeting. Members can obtain passes for transportation from the Secretary of the Institute. Negotiations are in progress for reduced rates to Hagerstown, Md., the northern terminus of the Shenandoah Valley Railroad, and members will be duly informed if reduced rates are obtained. It is necessary that the Local Committee of Arrangements in Roanoke should know promptly how many members will attend the meeting and the number of ladies who will be in the party. Members are therefore urgently requested to give notice to the Secretary of the Institute, as soon as possible, of their intention to be at the meeting. It is also desired that members will inform the Secretary what route, day, and train they will take, as additional railroad facilities may be obtained where there is a large party traveling together.

The train leaving New York at 8 o'clock P M., daily, has a through sleeping car to Roanoke, arriving at 4.25 P. M. next day. Members are advised to secure sleeping-car berths early. It is suggested that the journey may be very pleasantly broken by stopping over Sunday, either coming or going, at Luray or the Natural Bridge, where good hotel accommodations will be found.

Any additional information which members may desire with regard to trains, etc., will be furnished by the Secretary of the Institute or by the Secretary of the Local Committee at Roanoke. Time tables of the excursions will be given in the program of the Local Committee

Local Committee of Arrangements.—In Roanoke—J. H. Bramwell, Chairman; J. H. Sykes, Secretary. Dr. F. Sorrell, Frank Maddock, Maj. Andrew Lewis, J. Allan Watts. In Lynchburg.—Capt. C. M. Blackford, Chairman; John H. Flood Geo. M. Jones, P. J. Otey, W. B. Robertson, T. B. Deane, C. W. Button, T. D. Davis, H. Grey Latham, Alex. McDonald. L. S. Marye, John Stevenson, jr.

The first meeting of the American Institute in Virginia was held at Staunton, beginning May 30th, 1881; excursions were then made to mines, furnaces, and other objects of interest, on the lines of the Chesapeake & Ohio, the Shenandoah Valley and the Richmond and Alleghany railways, giving to the members of the Institute some idea of the mineral wealth, the manufacturing industries, and the general character of the central portions of Virginia and West Virginia; the portions where, up to that time, the largest developments in mining and manufacturing had taken place. All the members of the Institute that attended that meeting expressed themselves as greatly delighted with and interested in what they had seen; but the Virginians insisted that but a small portion of the vast mineral and other wealth of these states, much of it undeveloped, had been inspected—especially as they had not visited its southwestern section,—and urged that another summer meeting should be held at an early day in that part of these states. In response to that request, cordially repeated at each subsequent meeting of the Institute, the hospitalities of the citizens and corporations of Virginia, as expressed in the preceding program, have again been accepted, and the summer meeting of this year, 1883,

county 31,205 of which only 112 were of foreign origin.—The views of the Blue Ridge and its spurs and outliers are very fine from this town.

From near Forest the railway follows the waters of Blackwater creek to Lynchburg, giving many opportunities for seeing the stratification of the Archaean rocks and the deep erosions that have been made into them.—Rogers considered these rocks Laurentian from Liberty to Forest, and Huronian in the vicinity of Lynchburg.

Lynchburg on the James, 147 miles by Richmond & Alleghany RR. from tide water at Richmond, is one of the most thriving trading and manufacturing towns in Virginia; its population in 1880 was 15,959, of which 7,485 were whites and 8,476 negroes; of these only 398 were of foreign birth; it is ranked 4th among the cities of the state in population.—Tobacco is Lynchburg's staple for trade and manufacture, the yearly transactions in "the weed" amounting to millions of dollars. It has great advantages of location for iron and other manufactures, being at the intersection of three far-reaching railways and near many kinds of raw materials. It has a blast furnace and some prosperous iron-works. The exhibit of minerals from its vicinity is a very suggestive and attractive one.—It is not necessary to say that its people are hospitable; the members of the Institute will find that out.

No. 2.—*R. & A. RR.: Lynchburg to Riverville.*

Stations.	County and State.	Miles from Lynchburg.	Feet above Tide.
Lynchburg	Campbell, Va.	0.00	583.5
Joshua Falls	" "	10.75	455.0
Galtville	Amherst, "	13.75	455.0
Stapleton	" "	15.85	447.0
Walker Ford	" "	20.35	431.0
Riverville	" "	23.59	423.0

The run down the James, over the Richmond & Alleghany RR. presents many features of interest. The Huronian rocks—schists, slates, granites, etc.—are well displayed in the bluffy banks of the James; the vast wasted water-power of that river is forcibly seen at the old canal dams; the wide belt of iron ores and limestones, that has been partially developed, is a most interesting feature of the northeast-southwest trending portion of the valley of the James, that along the common border of Piedmont and Midland Virginia. The developments that have been made in the hill near Walker Ford station, on Boteler's land, by a drift, indicate the existance there of a large quantity of high grade magnetic ore, that by analysis of John S. Kennedy yields 58.14 metalic iron, 10.38 silica, 0.155 sulphur and 0.018 phosphorus.—The ores near Stapleton, Riverville and Greenway have been extensively mined. The paper of Dr. Persifor Frazer on the "Iron Ores of the Middle James River," read at the Staunton, Va. meeting of the Institute, that, with revisions, has recently appeared in the Transactions, is a valuable contribution to our knowledge of these ore deposits.—Dr. F. claims that the ore-bearing rocks of this belt are Huronian, and of the same age as those of Michigan, that contain the famous Marquette ores. This paper gives the details of results of mining on the ore veins of this region at numerous points.—This paper contains over eighty analyses of samples from seven diferent mines of this region; the averages of all these are, 48.69 metalic iron, 0.07 phosphorus and 23.98 silica.

Excursions around Roanoke, June 6th.

The visit to Crozer furnace and Upland iron ore mines will be over the Norfolk & Western RR. as far as Blue Ridge Springs, as described above.

Crozer furnace is worthy of a close inspection as Messrs. Witherow & Gordon, the well and widely known blast furnace engineers of Pittsburg, Pa., contractors for its construction, have introduced into it a number of new features designed to promote economy and efficiency of production.

At Upland mines a good opportunity is afforded for seeing the great thickness and regularly stratified condition of the No. I or Potsdam limonite ores of Virginia; a condition of things that will also be seen at Gale mines of Rorer Iron Co., later in the day, and that can also be seen at the Starkey mine, some two miles further to the southwest, at the Bott mine still further on, beyond Salem, in the continuation of the same Western Blue Ridge range, and so on to the southwest to Tennessee.—These vast beds of iron ore are, as any one can see, as regularly stratified as are the rocks that accompany them. As stated before, the Upland mines are on the eastward slope of a wasted Potsdam anticline; the specular ores of this formation underlying the limonites may be seen here.

No. 3.—*S. V. RR.: Roanoke to Houston.*

Stations.	County and State.	Miles from Roanoke.	Feet above Tide.
Roanoke	Roanoke, Va.	0.0	907
Tinker Creek	" "	2.8	968
Cloverdale	Botetourt, "	7.1	1,125
Troutville	" "	11.4	1,300
Houston	" "	14.7	1,348

Returning to Roanoke the visit to Houston mines is by the Shenandoah Valley RR., passing the stations above named. The railway goes up Tinker creek of the Roanoke, and its branches, to the water-shed of the Roanoke and James rivers, crossing the divide between Troutville and Houston, Ft. Lewis mountain and its northeast extension, Brushy ridge, are prominent objects to the west, on the left (See structure of this range on Section No. 2), and still more striking is the detached fortress-like Tinker Knob, opposite Cloverdale, sometimes called Dead-man mountain from its fancied resemblance to a gigantic corpse covered by a winding sheet. Tinker knob, as Section No. 2 shows, is an undulated mass of No. IV (Medina sandstone), resting on No. III (Utica and Hudson slates). On the right, from Roanoke to Cloverdale, is same Mills mountain that was seen on the left in going to Upland.

After passing Cloverdale—just beyond which, on the left, is the site of the old Cloverdale furnace, built about 1830 and abandoned about 1849, the Fort Lewis mountain chain terminates abruptly, in Tinker mountain, and The Valley broadens to 15 miles, bounded by the Western or Potsdam Blue Ridge on the east and by the North mountain range (here called Price, Caldwell and Crawford) on the west; most of this lovely expanse is embraced in Botetourt county.—The great Rich-patch chain—the one in which are the Clifton Forge, Low-Moor, Callie, Wilton, Roaring Run, Grace, and other iron mines, some of them visited at the previous Virginia meeting—is seen far to the northwest, towering above the North mountain range.

The Houston mines are, as before stated, in the westward slope of the same Potsdam anticline that has Upland in its eastern slope. Here can be seen to great advantage the wonderful decay of the ferriferous shales and slates of formation No. 1, characteristic of this ore belt in many places along the Blue Ridge. The clays resulting from this decay have rolled, crept and slid, as tenacious sheets, down the slope of the anticline carrying along the included ores, and involving them in their curiously contorted folds. The manganiferous beds of this formation are here largely developed, their product being well suited for spiegel, for which the ores of this mine are sent to the Cambria, Pa., works. The limonites of this mine are used in Crozer furnace.

In the long North mountain range that appears across the Valley, to the north, from Houston, are very remarkable beds of iron ore, of high grade, in the top portion of formation No. III, the Hudson River slates. These stratified beds have

(Continued on page 81.)

Coal and Coke Traffic of Ches. & Ohio Ry., April, 1883.

General Manager C. W. Smith sends *The Virginias* the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during April, 1883, and April, 1882, in tons of 2000 lbs., compiled by fuel agent C. M. Gibson :

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	538	1,467	.....	929
Gas	38,369	25,388	12,981	.....
Splint and block	8,355	8,189	166	.....
New River, &c	38,965	31,879	7,086	.....
Coke	9,142	8,106	1,036	.....
Totals	95,369	75,029	21,269	929

This shows a net gain of 20,340 tons, or over 27 per cent, in April, 1883 over same month of 1882.—A reference to page 61 shows that the gain in March was about 11 per cent; so that for April is more than twice as much; indicating a rapidly increasing coal and coke traffic. The gain over March, 1883, was mainly in Kanawha gas coals.

The distribution of the above was as follows:

	1883.	1882.
1. To C. & O. Co. for its own use	26,395	12,880
2. To Huntington, for West via Ohio river	3,358	4,340
3 On Elizabethtown, Lexington & Big Sandy RR	3,603	3,548
4. On Ches. & Ohio Ry., excepting Richmond.	17,102	12,396
5 To Richmond & Alleghany RR. at Clifton Forge.	2,204	2,167
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	.....
7. To Shenandoah Valley RR. at Waynesboro	31	893
8. To Va. Midland Ry. { At Charlottesville	6,638	1,119
8. To Va. Midland Ry. { At Gordonsville	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR Junc	159	1,235
10. To Richmond for consumption, including tugs, &c	8,900	10,730
11. To James River wharves for shipment	5,833	25,721
12 To Newport News { Consump'n includ'g tugs &c,	407	.....
12 To Newport News { For shipment	20,739	.....
Totals	95,369	75,029

The striking features of this distribution are those of several months past ; a large increase for C. & O. use, for consumption on the line of that railway, and for shipment at Newport News.

The following table presents the progressive traffic from January 1 to April 30, inclusive, for 1883 and 1882.

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	8,802	7,776	1,026	.....
Gas	119,503	92,517	26,986	.....
Splint and block	37,486	51,081	.....	14,495
New River, &c	143,287	111,214	32,073	.....
Coke	40,610	34,074	6,536	.....
Totals	349,688	297,562	66,621	14,495

The net gain in the traffic of 1883 over that of 1882, up to May 1, appears from the above to be 52,126 tons, or over 18 per cent, against one of 14 per cent noted in our last, (page 61). While all the kinds of mineral fuel, except splint and block coals, share in the gain, the large percentages are in Kanawha gas and New River steam and coking coals.

The increased gains of the four months of 1883 that have passed, indicate that the coal and coke traffic of the Chesapeake & Ohio will this year reach not less than one and a half million tons.

Lumber Traffic of Chesapeake & Ohio RR. for Three Years.—Mr. William L. Rawson, lumber agent of Chesapeake & Ohio Ry., has kindly furnished *The Virginias* the statistics of the lumber traffic of that road — in car-loads of 10 tons (2000 lbs.)—for the years 1880, 1881 and 1882 ; only counting the lumber from which revenue was obtained. From these data the following facts are derived:

Destination.	1880.	1881.	1882.
Newport News	.....	.....	1,238
James R. wharves	2,727	3,141	3,509
Richmond	720	1,173	1,354
Gordonsville } Charlottesville	213	320	925
Staunton	262	346	301
Huntington	436	1,045	1,554
All other points	1,635	2,334	2,794
	5,993	8,359	11,675

The Newport News and James River wharves lumber is for coastwise and foreign trade, that to Gordonsville and Charlottesville includes shipments north and south by Virginia Midland Ry., that to Staunton shipments north and east by Baltimore & Ohio RR., and that to Huntington shipments west by E., L. & B.-S. RR. and by Ohio river.

The traffic of 1881 was over 39 per cent more than that of 1880; and that of 1882 was very nearly 40 per cent more than that of 1881, and more than 95 per cent gain on that of 1880,

The following table presents the car-loads of this traffic for each quarter of the three years here reported.

	1880.	1881.	1882.
First quarter	1,011	1,000	1,758
Second "	1,459	2,042	3,349
Third "	1,727	2,585	2,886
Fourth "	1,796	2,732	3,682
The year	5,993	8,359	11,675

In 3rd quarter of '80 the Shenandoah Valley RR. received 68 cars, and in 3rd quarter of '81, 110 cars that are credited to Charlottesville and Gordonsville. Of the lumber taken to Newport News in 3rd quarter of 1882, 38 car-loads were exported and 150 shiped coastwise; of those in 4th quarter of 1882, 424 were exported and 231 sent coastwise ; indicating the opening of a large trade in lumber from that best of shiping ports.

Counting 5,000 ft. board measure for a 10-ton car-load (which it would be if it were all dry oak), the movement in 1880 was about 30,000,000 ft. ; in 1881 about 42,000,000 ; and in 1882 about 58,000,000.

A large proportion of this lumber was white oak and tulip-poplar from the fine forests of West Virginia tributary to this road.

The Growing Value of Kanawha Coal Lands is well illustrated by the following statement from a letter recently received by the Editor from Major Thos. L. Broun of Charleston, W. Va., who has probably done more than any other citizen of the Great Kanawha region to make know the extent and character of its vast coal and timber resources:

"About the first contract, as an attorney, that I drew up, was one between James G. Paxton, of Lexington, Va., and Lewis D. Wilson of this place. It was in 1853, when Paxton purchased of Wilson 1,700 acres of coal land for $1,700, or one dollar per acre. This land fronts on the Great Kanawha river and the Chesapeake & Ohio Ry. and Crescent and Frederick stations are now on it, and in it are the Crescent, Eagle and Frederick collieries, operated by Johnson, Wyant and Faulkner, respectively, and which now pay an annual rental of $17,000 in royalties."

We know that Major Broun's statements are in accordance with the facts ; and yet, similar lands and others containing, from their location, more coal, lying in the same re-

gion and within a few miles of the Chesapeake & Ohio Railway, can now be bought at from $10 to $30 per acre,—land that will yield from 1,500 to 3,000 tons of coal to the acre, the royalty on which, at but ten cents per ton, would be $150 to $300 per acre. We do not know of anything that can offer better inducements for the safe investment of capital than these Kanawha coal lands.—*Editor.*

Connellsville, Pa., vs. New River, W. Va. Coke.

In the "Keystone Courier," Connellsville, Pa., of May 18, we find the following article, under the bold headings—"Deluded Dewey. Reply to a government theorist. A Practical Man Shows Just How Little a Professor in the National Museum Knows About Coke. Written for the *Courier*, by John Fulton M. E."—as a reply to the letter of Curator Dewey of the National Museum, published on page 51 of the April, 1883, number of *The Virginias*, criticising an article, by Engineer Fulton, published in full on page 40 of our March, 1883, number.—We invited a free discussion of this question, therefore the reply of Engineer Fulton is given below in full.—*Editor.*

"In the April number of *The Virginias*, an article appears from Prof. Dewey, of the National Museum of Washington, D. C., under the caption of "Connellsville vs. New River Coke," which is designed as a reply to the writer's paper on this subject, printed in the "Courier" of February 9th, 1883.

It was rather a grim joke of the editor of *The Virginias* to call upon a Museum Professor for an article in defense of New River coke

The Professor in the Museum disavows at once any intention of "entering into the discussion of the relative value of West Virginia and Connellsville cokes." Just here, the inquiry is pertinent, What moved the Professor to write at all, if not on the theme under friendly discussion—the relative merits of Connellsville and New River cokes?

It was quite reasonable to hope that he would make some contribution to our knowledge of the physical or chemical properties of coke for blast furnace use.

But we are met all through this brief article by a trifling that has its counterpart only in Shakespeare's illustration of the pedagogue in "Love's Labours Lost," where this prominent character is made to say in criticisms of Nathaniel's rendering of Biron's love epistle:

"You find not the apostrophe, and so miss the accent; let me supervise the canzonet. Here are only numbers ratified; but for the elegancy, facility and golden cadence of poesy, caret. Ovidius Naso was the man; and why, indeed, Naso; but for smelling out the odoriferous flowers of fancy, jerks of invention! Imitari, is nothing."

Evidently the editor of *The Virginias*, Major Hotchkiss, was not deeply impressed with the value of Prof. Dewey's production, for he gives his readers notice that *The Virginias* has made arrangements with a thoroughly competent chemist and physicist, one having the best laboratory appliances for this purpose at his command, to fully and thoroughly determine the chemical and physical properties of the principal cokes not only of West Virginia and Pennsylvania, but also of the other coke making states."

But to return to Prof. Dewey's article, which might aptly be termed a letter from the man of "disappointed hopes." The sole reason given is, that Mr. Fulton's article on coke does not supply what he wanted to relieve his mind on "the subject of the porosity of rocks." In this he tells us he was "sadly disappointed." The author of the table on the physical and chemical properties of coke, can only express his regrets that it is not of sufficient circumference to embrace this and many other important topics in science—the porosity of rocks, the transit of Venus, &c., &c. Seriously, it was not candid in Prof. Dewey to say that he would not enter into a discussion of the relative value of cokes, and then proceed to do so by impeaching the methods of physical tests used in the table he quotes. He is not accurate in stating that he does it in the interest of "truth," because he presently assumes what is not truth, and what he readily could have ascertained before committing himself to such an egregious blunder.

Now for "the square issue taken." The design of the author of the table of the physical and chemical properties of coke, was to measure the cell spaces of coke, approximately estimating the relative proportions of this fuel, affording ready access to the reducing gases of the blast furnace and indicating, in correlation with other properties, the calorific energy of the coke. It was the design to exclude the porosity of the coke as far as possible. Prof Dewey includes the pores; this is the difference. The second "square issue" relates to the order of cellular space as given in this table. Here the Professor tells us in the most rigid arithmetic, his utter want of knowledge of coke in its simplest properties. He declares the whole table inaccurate, because a coke inheriting 25.57 per cent of cells is classed the same as one with 41.73 per cent, while a coke with 41.73 per cent of cells is rated as I. A coke with only 41.01 per cent of cells or pores is rates at I½, (a lower condition of physical structure,) and suggests that "the proper way would have been to call the coke with the largest cellular space, unity, and rate the others accordingly."

The original blunder follows the Professor all through his article, embracing the pores with the cells, in the effort to rate the value or order of coke from this one determination. According to Prof. Dewey the cokes would rank as follows:

Cumberland coke	1.0000	Illinois	.6694
Broad Top,	.9493	Alabama	.5626
Connellsville	.8782	Clearfield	.5625
West Virginia	.8376		

Now the fact is, that in the above table of Prof. Dewey, he places the worst coke in the whole lot at the head of the list. This Cumberland coke is a soft, punky coke, easily cut with the knife, and utterly worthless for blast furnace fuel.

In the ultimate determination of the relative values of cokes as blast furnace fuels, the cellular space and hardness are calculated in intimate correlation. A hard coke is a cellular coke; a soft coke is a porous coke. This will explain the column of the table which has given the Professor so much disappointment, the rating of a soft coke inheriting a large porous ratio, below a coke inheriting a less cellular ratio. The hardness of the latter assures its *higher order of cellular space.*

An inspection of the table in question will convince any candid mind that none of the determinations have in the most remote manner detracted from the value of New River coke. It has been given a first order in cellular space. Its hardness and burden-bearing properties one under the Connellsville, which places it next to this coke.

But the Professor closes with a severe admonition that "the attempt to draw conclusions from a single set of experiments, which is hazardous, the table contains other minor discrepancies, but I think I have said enough to demonstrate its entire lack of value."

It must have been a desperate strait that evolved a reply that consists in a series of captious assertions, arising from a misconception of the methods used in the table, displaying an egotism and recklessness of statement that must incapacitate any mind from contributing to the cause of truth in this or any other department of science."

The Geological Formations of the Virginias.

By Prof. Wm. B. Rogers.

(Continued from page 61.)

Note.—In preceding numbers of *The Virginias* we have given descriptions of the geological formations found in Virginia and West Virginia from No. I. to No. XI., inclusive, from the manuscript note books of Prof. Rogers ; to complete these descriptions, so they shall include all the formations of his Virginia reports, we will now give descriptions of the formations above No. XI., taking them from those rare reports, as they are not found among the manuscript notes. —*Editor.*

Formation No. XII—the 14 a. Great Conglomerate and Conglomerate Coal Group of the general system of the U.S; the Seral of the Rogers brothers of the 1st and the Pottsville Conglomerate of Lesley of the 2nd Pennsylvania survey; the formation that with our present knowledge of its great and widely extended beds of coal ought, beyond question, to be called the Lower Coal Measures of the Upper Carboniferous general group,—is described as follows in the Virginia Geological Report for 1839, page 93:

"This formation, strongly contrasted in its general aspect and composition with the preceding, which lies immediately beneath, consists of a group of whitish or light grey sandstones, generally of a coarse texture, and comprising heavy beds of conglomerate, usually conspicuous for the white polished round pebbles of which it is mainly composed. The loose and open texture of these coarser rocks, causing them to crumble by long exposure to the weather, occasions the disengagement of the pebbles, which are thus seen profusely strewed over the surface in many places where this formation occurs, becoming in fact a useful geological land-mark where the rock itself is concealed from view.

This beautiful white gravel is met with in great abundance, accompanying the massive strata of the conglomerate, high up on the eastern front ridge of Alleghany mn. west of the upper termination of formation XI.

The same coarse rock, with its attendant pebbles, is found in a similar geological position on the Backbone of Alleghany, on the Cheat mountain and Laurel hill, as well as on several other minor ridges. It is also well displayed on the summit of Big Sewell and various knobs and ridges of the adjacent region, and forms the nearly level caping of Blue Stone mountain and its continuation further to the southwest. Everywhere along the margin of the great coal region, this formation may be seen, marking the transition from the upper member of the Apalachian series of rocks to the widely expanded groups of strata with which the coal seams are associated.

It is not however to be infered that at all points it displays the same conspicuous conglomeretic structure, or is developed to the same thickness, for in both these particulars it presents frequent and important fluctuations, passing from a mere mass of large rounded pebbles cemented by siliceous matter, chiefly at their points of contact, to a conglomerate of shot-like gravel, and thence to a coarse, and in some cases, to a fine sandstone of even and compact texture, and in thickness varying from a thousand, and perhaps more, to a hundred, or even less than a hundred feet.

Nor in all classes does it throughout maintain the character of a purely siliceous rock, for instances occur in which bands of slaty sandstone, and even bituminous slate, accompanied by one or more seams of coal, are included between the coarser and more massive strata of the formation. Yet with all these variations, the general characters of the group as above described, are sufficiently definite to enable the practised observer to recognize in it when it appears, and its features usually are so well marked that a glance is sufficient for this purpose.

It will readily be seen, from what was before stated in regard to the general arrangement of the strata, in and adjoining the coal region, that the upper position, geologically, of this or any other group of rocks, does not necessarily imply an actually greater elevation above the general level of the region, compared with rocks geologically inferior. The positions as to height of the various rocks of the great basin, or of any of the axes within its confines, is greatly determined by the extent to which they have resisted, or yielded to the denuding agencies, to which, as formerly illustrated, they have been everywhere more or less exposed. On this account the formation of which I am speaking is often absent for great distances along the top of an anticlinal mountain, while low down upon the flanks of the ridge it may be seen in enormous blocks, or thick continuous strata diping away in opposite directions from the enclosed and underlying beds of XI., while the latter rising in undulating hills along the intervening space, tower far above the strata which once extended as a connected covering entirely over the mountain from side to side.

It will at once be infered from what has now been said as regards the geological position and usual characters of this formation, that as a general rule, explorations in pursuit of coal should be directed to the series of strata, lying *above* it in geological position, and that where the outcrop or margin of the conglomerate may be clearly traced, we are to be governed by the direction in which the strata dip, in selecting the line most suitable for our examinations. Where for example these strata are seen inclining downwards towards the NW., we would take our departure from the margin of the basin marked out by the beds of conglomerate, and traveling in the direction of the dip, or towards the NW., we would enter upon the upper and coal bearing strata lying within, and thus successfully encounter the coal seams and their accompanying rocks in the order of their superposition. It should be observed, however, that in applying this rule it is, of course, presumed that the route thus pursued is along a line which, if not horizontal, descends towards the centre of the basin at a less angle than the dip of the conglomerate and overlying rocks, for otherwise we might continue upon one or other of these beds throughout nearly the whole of our course; or, if following a line of very deep denudation, might penetrate below the conglomerate into the formation which lies beneath.

The remarkable expansion and diversified character assumed by this formation for some distance within the margin of our great coal field in the western parts of Pocahontas and Greenbrier counties, has caused it there to overspread a wide area, and to include along with the usual beds of conglomerate numerous beds of slate and sandstone, varying in hue and texture, together with seams of coal of sufficient magnitude and purity to be esteemed worthy of exploration. Of the exact limits of this remarkably diversified group of strata, it is as yet impossible to speak with confidence. The undulating directions of the beds and the topographical peculiarities of the country having presented difficulties in the way of a precise solution of this problem, which can only be removed by further examination. This much, for the present, may be stated, that the coarse and partially conglomerate sandstone composing the celebrated cliffs of New river, skirting that stream on both sides for some distance in the form of lofty mural precipices, and prolonged with a northwesterly dip, so as to constitute the wide sheet of nearly level strata over which the Kanawha is precipitated at the falls, is to be regarded as occupying the same

place geologically with the similar strata forming the general margin of the region occupied by the coal bearing strata; and in confirmation of this view it may be added, that the series of sandstones, slates, and coal seams so admirably exposed in the lofty hills extending along both sides of the Kanawha to some distance west of Charleston, and which have been ascertained to overlay this conglomeritic rock according to a nearly invariable order, are in all important features analogous to the group of coal bearing strata elsewhere found resting next above formation XII. It would therefore appear probable that a part, if not all the coal seams associated with the rocks of the Big Sewell mountain appertain to a lower group of coal rocks, forming a portion of the formation of which I am treating, here widely expanded and wonderfully diversified in its characters. But as already stated, further investigation is required to determine with exactness the true boundaries of this formation, and therefore the true relations of the various rocks in question."

The Virginia Papers of Prof. Wm. B. Rogers.

Washington & Lee University,
Lexington, Va., Feb. 22d, 1883.

Maj. Jed. Hotchkiss:

My dear Sir:—The Geological world will give Mrs. Rogers and yourself a unanimous vote of thanks, when you issue the promised edition of Prof. Wm. B. Rogers' papers and reports on the Geology of Virginia and West Virginia.

Workers in our special geological field have already been greatly benefited by access to the few extant copies of those reports, and all are looking forward with the expectation of great satisfaction and important instruction from this new and enlarged edition, with its maps and illustrated sections.

To myself, personally, and no doubt to all others engaged in the study of the geology and mineral resources of the two Virginias, Prof. Rogers has proved a most valuable guide, occasionally hesitating himself, as all *safe* scientific investigators do, but rarely making a false step.

In cases where he had not fully examined any geological feature or formation, and was not prepared to express very full and decided views in regard to it, he rarely failed to see enough and to say enough to foreshadow what would be the result of more thorough investigations.

As an illustration of these remarks, let me call attention to the first epoch in the history of that member of the Carboniferous series to which Prof. Rogers has happily given the title, "Conglomerate Coal Group." The opinion seems to have been held by the earlier geologists of this country that the Great Conglomerate—the Millstone Grit of England—was a simple, heavy bed of conglomeritic sandstone, underlying all of the productive coal beds of the Apalachian field. But it is now recognized to be, at least in some portions of its extent, an important division of the true coal measures. This discovery, however, is not *as new* as some writers might lead those to infer who have not had access to Prof. Rogers' Virginia Reports. The Conglomerate Group has doubtless turned out to be more important, especially in the New River (Kanawha) valley, and the S. W. counties of Virginia, than he inticipated when he wrote about it, more than 30 years ago, in more of a prophetic than of a historic style.

He then maped out a track on which many of us have since been traveling, without being conscious, perhaps, at all times, in whose footsteps we were treading—forgeting for the time the feet that had first broken the difficult path.

He is writing about Nos. XI. and XII. of his old Apalachian series, (13 b. and 14 a. of his more recent Virginia Table) when he says:—"Still farther towards the southwest, (beyond New River) we find it (No. XII.) occupying the eastern slope of the Bluestone mountain, and with a very gentle inclination towards the northwest, diping beneath the coal rocks of the *Great Flat-top mountain*, which with a gentle slope in the same direction spread continuously thence towards the valley of the Ohio."

No. XII.—"This formation, strongly contrasted in its general aspect with the preceding which lies immediately beneath, consists of a *group* of whitish or light gray sandstones, generally of a course texture, and comprising heavy beds of conglomerate, usually conspicuous for the white polished round pebbles of which it is mainly composed." . . . . "It is also well displayed on the summit of the Big Sewell and various knobs and ridges of the adjacent region, and forms the nearly level caping of the Bluestone mountain and its continuation further to the southwest." . . . . . "Nor in all cases does it throughout maintain the character of a purely silicious rock, for instances occur in which bands of slaty sandstone, and even bituminous slate, accompanied by *one or more seams of coal*, are included *between* the coarser and more massive strata of the formation." . . . . "The remarkable expansion and diversified character assumed by this formation for some distance within the margin of our great coal field in the *western part of Pocahoutas* and Greenbrier counties, has caused it there to overspread a wide area, and to include along with the usual beds of conglomerate numerous beds of slate and sandstone, varying in hue and texture, together with *seams of coal of sufficient magnitude and purity to be esteemed worthy of exploration.* Of the exact limits to this remarkably diversified *group* of strata it is as yet impossible to speak with confidence." . . . . "It would appear probable that a part if not all the *coal seams* associated with the rocks of the Big Sewell mountain appertain to the lower *group of coal rocks*, forming a portion of the formation of which I am treating, have widely expanded and wonderfully diversified in its characters." . . . . .

"The wide tract occupied by formation XI., instead of presenting along its western boundary a regular escarpment composed at top of the conglomerates and sandstones of XII, is here intersected by deep and long valleys connected with the waters of Greenbrier and New rivers, between which rise lofty knobs and broad ridges crowned by the conglomerate at their highest points, and which, encroaching upon the intervening valleys as we trace them towards the southwest, coalesce to form the *Great Flat-top mountain* south of New River."

Here we have the "Conglomerate Coal Group" so well outlined in Virginia that it seems to me altogether proper to let it carry the title given it by our great Virginia geologist during the closing years of his life. For to him belongs the honor of having laid the foundations here and elsewhere upon which you and others have been so successfully building for a number of years.

Very truly yours,
J. L. Campbell.

The Porous Anthracite or Natural Coke of Virginia, found in the coal mines of the Richmond basin, was the subject of a paper that Prof. Wm. B. Rogers communicated to the Association of American Geologists and Naturalists at a meeting held in Boston, in 1842. In that paper Prof. R. investigated the cause of the peculiar texture and composition of this material, and pointed out the forms of vegetation from which it and the neighboring bituminous coal had been chiefly derived. From the position of the coke beds, as compared with those of the bituminous coal, and the frequent interlamination of the two, he proved that the non-bituminous character of the former could not have arisen from the effects of heat on a seam of bituminous coal, but must be ascribed to the thorough carbonization and dessication of the vegetable matter before it was *sealed in* by the overlying strata.

Notes on the Mineral Deposits at certain Localities on the Western Part of the Blue Ridge.

By Wm. M. Fontaine, Professor of Geology in the University of Virginia.

(Continued from page 59)

Mine Bank of the South River of the James.—The old Cotopaxi furnace is situated at the exit of the South river of the James from its mountainous portion, in which it forms for some distance a gorge. About 3 miles distant from the furnace up this gorge, there is an important deposit, or rather two deposits of ore, the property of Isaac Newton of Greenville. For the sake of brevity I shall refer to this ore as Newton's Mine bank. In my visit to this ore I was not enabled for want of a guide to extend my examinations beyond Newton's deposits. I was informed, however, that on the land belonging to J. I. A. Trotter and others, the same ores are found. From the mode of occurence of the ore on Newton's property, I feel sure that considerable exposures of the same ore may be found on the adjoining lands, wherever the top of the Potsdam quartzite is exposed. A reference to the section up this river will show that probably conditions similar to those found at Newton's Mine bank, may be found over an extensive area in that vicinity.

At Newton's Mine bank the gentle S. E. dip of the Potsdam quartzite has brought the top of this group of rocks below the plane of erosion, and permited the exposure of an area of the Ferriferous shales. Even without a knowledge of the geological structure an inspection of the ore would convince any one that it belongs to the Ferriferous shales, and not to any of the ore horizons in, or under the quartzite, for it is the characteristic mixed manganese and iron that occurs so commonly just above the quartzite, and which I have never seen below it. The ore of Newton's Mine bank is found not far above the top of the quartzite. After passing up to the top of this rock, we find lower down the hill a more westerly deposit of ore which I shall call the western deposit. Higher up the hill, and farther east about 200 yards, is another line of deposits which I shall call the eastern deposit. Both of these appear to occur in the form of a more or less connected series of ore-bodies that may form connected ledges. At any rate the ore may be traced as a float on the surface in the prolongation of the length of the ore-bodies, as exposed in the openings. The western deposit is the most extensive. It has been opened at one point by a cut 15′ deep and shows the cross section of the ore-body very well. The following section was made across the ore from east to west: 1.— 8′ of redish brown hematite, much of it rather silicious in character; 2.—5 of mixed hematite and psilomelane, the two being visibly mixed. In this portion the manganese sometimes forms films and lumps in the iron, which is often bright red in color. Lumps and particles of nearly pure manganese could be selected from this portion. The films of manganese are intimately mixed with the iron. 3.—7′ of highly manganiferous ore, and nearly black in color; 4.— 14 of mixed iron and manganese ore, having bands and pockets of nearly pure manganese ore. The width of the whole deposit is about 36′. Specimens of the average mixed iron and manganese ores from this deposit, show of metalic iron 24.6 per cent, of metalic manganese 15.7 per cent. Some of the ores from No. 3, that appeared to be richest in manganese, exhibited on analysis, 13.5 per cent of metalic iron, and 31.3 per cent of metalic manganese, showing a high content in manganese. Another specimen of a more shaly ore showed 6.2 per cent of metalic iron and 28 per cent of metalic manganese. The latter evidently is an argilaceous ore, and leaner than usual. This is generally true of the softer mixed ores with shaly structure. It is clear that much of this more western deposit is very rich in manganese.

The eastern deposit is narrower than the western, but the ore is more massive, and contains less of earthy impurities. This ore is also manganiferous. It is opened in several places by shallow pits. It shows generally from 8′ to 10′ of solid ore, but sometimes swells out to 13′. A common ore here is rather dark brown, with spots of much darker color, which appear to be due to more manganiferous portions. Some of the ore is composed of manganese mixed in seams and films with the iron, and sometimes quite large masses appear to be nearly pure manganese. Analyses of the ores from this deposit show for the mixed ore that is richest in manganese, metalic iron 13.5 metalic manganese 31.3 per cent. The spoted ore has metalic iron 23.8 per cent, metalic manganese 13.6 per cent.

The amount of ore that may be obtained from these two deposits is large, and most probably a very large amount exists on the adjoining lands. The South river near this place descends over 100′, by a series of falls, giving good water power. It would appear that a furnace could be located with advantage in this vicinity,

Dogwood Hollow Ore.—Dogwood hollow leads up from the Kelley bank through the Potsdam quartzite ridge here called Cold Short mountain. The western face, and central portions of this mountain, are composed of the quartzite that has a high N. W. dip. Pretty high up on the S. E. slope of this mountain, and hence behind its crest, we find a very important deposit of hematite ore. This occurs in the flags of No. 4, near their passage into the quartzite. The ore in physical aspect and mode of occurence, is quite different from the ores of the Ferriferous shales. This ore is not imbeded in clay, but has walls of silicious flags and quartzite. It was clearly deposited in a crushed and fissured portion of the flags. But here the fissure seems to have been unusually wide, and the amount of ore deposited in it unusually large. Like the other deposits of ore at this geological horizon, the best ore occurs filling what were the open portions of the fissure, while there was a great deal of it found impregnating the wall-rock, and cementing the shattered fragments that form the immediately adjoining parts of the wall. As it has the character of a fissure vein, it may be traced along a definite line of strike, but with varying amounts of ore. The dip of the vein is nearly vertical, being about 80° to the N. W., which is the dip of the ledges that immediately adjoin it, and which by their abnormally high dip here show great local disturbance. The strike of the ore-vein is nearly due N. & S. while the strike of the enclosing strata is about 60°E. of N. Dogwood hollow lies at the N. E. foot of the ridge containing the ore. It is occupied by a stream that flows N. W. into South river. A small stream comes into Dogwood hollow from the S. W., and cuts down pretty deeply into the ridge containing the ore ledge. The hollow occupied by this stream we may call Bear hollow. The ore has been opened high up on the face of the mountain, and some of it has been taken out for use in Vesuvius furnace. A well graded road has been made from Dogwood hollow up to the openings. While the dip of the strata next to the vein is 80° N. W., the general dip of the inclosing strata some distance off, is 55°–60° N. W. The general mode of occurence of the ore is much like that of Mike knob, The immediate walls are composed of crushed silicious flags and quartzite, cemented for some distance by ore. The best of the ore forms a pretty uniform ledge 6′–8′ wide, filling what was the open part of the crevice. This portion has a rich dark chestnut, to black color, and a somewhat resinous lustre. The material is remarkably uniform in character, and free from earthy impurities, forming a solid heavy ore. The

vein extends to the S. W. to an unknown distance. I did not trace it in that direction. The most northerly opening is made close to the precipitous descent down into Bear hollow. We traced the deposit some distance in a northerly direction. It may be seen presenting an almost vertical sheet of solid ore 6'–8' and 10' wide, and 200' high on the side of Bear hollow. An immense quantity of ore has been broken down here by gravity, and great blocks have been carried down the slope into the hollow. I measured blocks 7'x 5'x 3' of pure ore. It is strange that with this condition of things before them, the ore-geters should have been at the expense of making a graded road to the deposit, when here it might be blasted off and thrown down into Bear hollow, whence a short road would take it into Dogwood hollow. Indeed it would be practicable to take the ore from the foot of the cliff by an incline to a good furnace site on Dogwood hollow. Over 1,000 tons of ore now lie detached by gravity on the sides, and in Bear hollow. The ledge of clean ore is here sometimes 8'–10' thick and the cemented walls 10'–15' thick. The ledge descends into the ground with the same character that it shows above ground, but to what depth cannot be stated. From its character as a vein this depth is probably very great. I traced the vein some 300 yards in a northerly direction, until it became hidden by the drift sent down by the Potsdam quartzite exposed higher up the mountain. The amount of ore that may be obtained here is enormous. From the physical appearance of this ore, and from the horizon of its occurrence, I was led to suppose that its content of phosphorus is comparatively high. This was confirmed by the name given locally to it, and the mountain that contains it. It is known in this vicinity as the cold short ore, and the mountain containing it is called Cold Short mountain. The analysis confirms this conclusion. It shows of metalic iron 57 per cent, no manganese and no sulphur. The phosphorus amounts to 1.2 per cent, it being computed here as in all other cases, as $P_2 O_5$, or the pentoxide.

The deposits above described have the following distances from the S. V. RR. Bare bank and Doyle's land 3¼ miles, Blue bank 1½ miles, Black Rock and McCormick bank ¾ of a mile, Mine bank of South river 4 miles, Fauber manganese deposits 1¼ miles, Dogwood hollow ore 1½ miles, Kelley bank ¾ mile. These distances are from points on the RR. where sidings could be made.

There are three old furnaces in the neighborhood, all of them gone to ruin. The oldest of these is the Maybury or old Marl Creek furnace. This was situated on Marl creek, about ¼ of a mile from the river. The situation gives excellent water power, and might be utllized as the site for a manufacturing establishment. Mere traces of this old furnace are all that exist ; it was wholly in ruins in the boyhood of a man now 77 years old. It was no doubt the pioneer of the furnaces of this section, and must have been built about 1775–80, when the old Clay-bank furnace near Waynesboro was built. Cotopaxi furnace, now almost wholly obliterated, was built about 1836 by McCormick, and operated for some time by him. It was then carried on by Mr. Bryan, and worked up to 1859. Since that time it has not been worked. Vesuvius furnace, situated about one mile below the mouth of Marl run, was operated about the time of the working of Cotopaxi. The building of furnaces so early as 1780, in the belt of country now in question, shows that the ores of this region attracted attention very long ago.

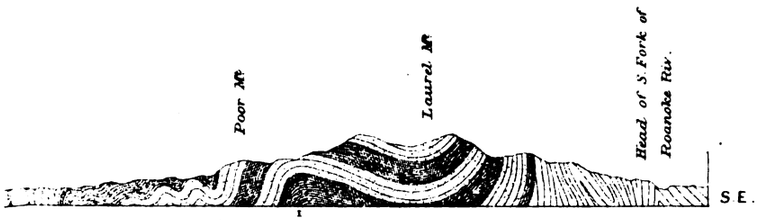
Gibbs' and Carson's Ore.—This ore is situated in the limestone west of Midway, and its location was described in the account of the limestones lying to the west of that place. The ore occurs on the lands of Messrs Gibbs and Carson, which join at that point. The ore is found mainly in two ridges lying near to each other. The eastern ridge is a broad low swell about 300 yards wide. It is composed largely of a cherty or silicious rock, that is highly ferruginous, and ranges from a jasper to a good iron ore. At the time of my visit, no large amount of exploration to test the ore had been made. A few open pits of small size and depth had been dug. Although most of the rock is too silicious to be workable, a large amount of good ore may be obtained, showing according to analysis 4 per cent and under of silica, and 50–54 per cent of iron. One of the pits shows a ledge of pretty good ore 5'–6' wide. The ridge is a siliceous band occuring in the limestones and shales of this vicinity. Its trend is about 36° E. of N., and it dies down after a course of 500–600 yards. On the western side of this ridge, at its northern end, we find a small hill composed of clay produced by the decomposition of ferruginous shales. This clay shows imbeded masses and lumps of nodular ore, formed by concretionary action out of the iron formerly diffused through the clay. This ore is largely in the form of shells enclosing more or less clay. It appears to be a good ore, and from its aluminous nature would give a good material to mix with the silicious ores of the ridge. A considerable amount of ore will be yielded from these imbeded masses. Some of it is quite dark and evidently has a considerable amount of manganese mixed with it. Some nearly pure lumps of manganese may be selected. About 300 yards to the west of the silicious ridge described above, another ridge is found also striking N. E. It contains a disturbed and much crushed band of limestone that is impregnated with silica and thin seams of calcite, which cement the fragments together. Some 200 yards west of the cherty ridge, and just west of the clays carrying ore, we find a remarkable ledge of ore striking about 50° W. of N. that intersects the ridge holding the disturbed limestone. The ore of this ledge may be found as surface fragments in a field nearly opposite the S. W. end of the cherty ridge, but here the ore does not show in place. From the mode of its mixture with the soil, it would appear to be in place under the surface. Passing from this point for some 100 yards in the direction of the course of the ledge we find in a piece of woods an abrupt low ridge, the crest of which seems to be nearly all composed of good iron ore. It has not been opened here, or anywhere else, but the bosses of ore stand up in such a manner as to show that all the space between them is occupied by ore. A measurement across this body of ore shows that it is 45' wide. The ore is without earthy impurities, and has a light brown color. It is very massive and compact, being apparently extremely pure. An analysis of a specimen selected as not being equal to the best ore shows 59 per cent of metalic iron, no sulphur, and .4 per cent of phosphorus. This ridge continues in the N. W. direction given above for about 150 yards, and then on intersecting the limestone ridge, it expands into what appears to be a boss of solid ore over 60' wide. All the ore visible here is very pure and massive. There seems to be no clay admixture with this ledge. This appears to have the character of a deposit in a crevice or fissure, made in the rocks by the force that crushed up the limestone. It thus differs in origin from the ordinary concretionary ores of the limestone and Ferriferous shales. The deposit crosses the limestone ridge for 100–200 yards, and may be traced by surface ore. It, however, seems to become quite silicious in this direction, and soon disappears entirely. This deposit is one of the purest known to me in this section, and will furnish a very large amount of good ore. It lies about 5 miles from the S. V. RR., and close to the line of the Valley RR. of B. & O. This latter will, I am informed, soon be built from Staunton to Lexington past this point.

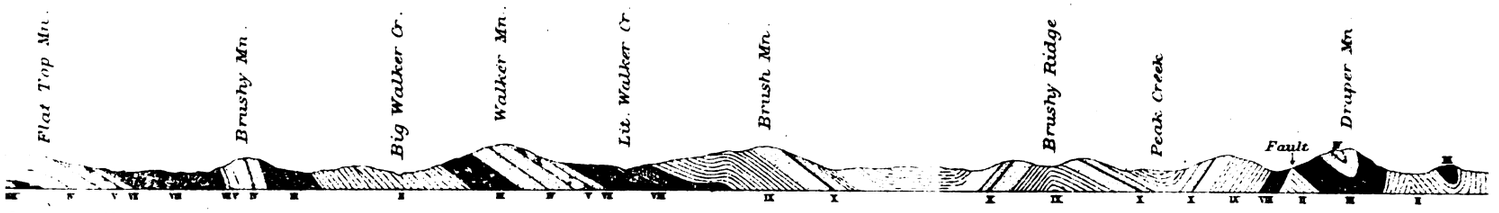
Big Mary Creek Ores.—These ore-deposits lie just N. E. of Big Mary creek, and to the N. W. of the quartzite mountain described in the section down that creek. They

Supplement to No. 41 of "The Virginias," May, 1883.

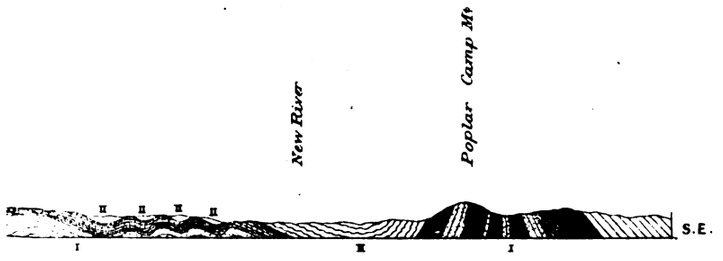
Geological Sections from the W. B. Rogers New Geological Map of Virginia and West Virginia.

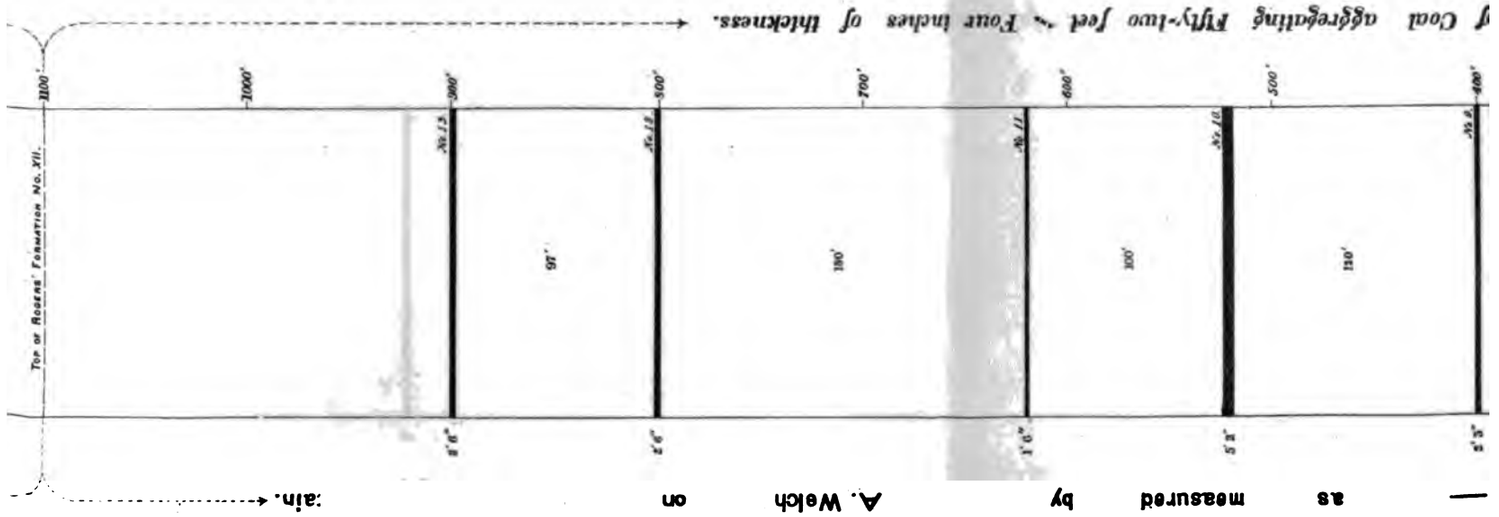
(Now in press.)





Great Flat Top Mountain, W Va.





Coal aggregating Fifty-two feet — Four inches of thickness.

as measured by A. Welch on ain.

occur in the Ferriferous shales on the land of Echols, Bell & Catlett. There are four openings on them, 200–300 yards apart, and all apparently on the same line of deposits. They are the last for some distance of the Ferriferous shales ores that have attracted any attention along here. Ore may occur at other points to the S. W. in these shales, but it is not known to occur in any quantity, the next deposit of value being the Buena Vista ores, excepting, perhaps the ore with dufrenite. To the N. E. there is a considerable interval, some 4 miles, to the Kelley bank, in which workable deposits of iron are not known to exist, though there are many surface indications both of manganese and iron. The opening farthest to the S. W: on the property of Echols, Bell & Catlett, is that called the Hite bank. There is here only a small pit that does not fully show the size of the deposit. A ledge is shown here disclosing about 6′ of good ore, mixed with manganese in the manner shown at the Kelley bank. Some lumps of pure manganese occur in the ledge, and much of the ore is visibly mixed with manganese. The ore occurs in a pretty solid ledge. About 200 yards to the N, E. of this point is the Fulton bank. This is opened by a more considerable excavation, and some ore has been taken out of this pit for use in Vesuvius furnace. As most of the ore here has been left standing, it could be seen to advantage. An ore-bearing ledge 55′ wide is shown. All of this, however, is not solid, good ore. A cross section shows the following arrangement: The mass is composed of solid ledges, made up of sheets or crusts, with a concretionary structure, separated by layers of clay that contain lumps of nodular ore. Starting on the S. E. side, we have first a ledge 6′ wide of pretty fair ore, but mixed with lean shaly ore. Then comes clay with crusts and lumps or ore 12′ wide. Next to this comes a ledge which stands up 14′ high, composed of pretty thick sheets having a concentric structure. Most of this is lean ore, but it contains a good deal of workable material. It contains some clay enclosed in hollows in the sheets or crusts. This is about 10′ wide. Then comes a band of clay 12′ wide, carrying lumps and small particles of iron ore and of manganese. This clay probably has below the surface the ore more massive. A slide has occurred in it, and its true character cannot be certainly made out. Then comes about 15′ of pretty solid ore in lumps and masses. A good deal of manganese is found in this portion, some of it is pretty pure, and some mixed with the iron, after the fashion of the Kelley and Mine bank ores. A large amount of ore is in sight here, and no doubt a good deal is hidden, for the opening is an old one, and earth has washed in from the sides. An analysis of an average sample of the best ore from this bank shows 53 per cent of metalic iron, and no manganese. The mixed manganese and iron, in the samples richest in manganese, shows 6 per cent of metalic iron, and 47 per cent of metalic manganese. This sample of mixed ore is richer in manganese than any that has been examined. This bank is ¼ mile from the S. V. RR., down grade all the way. A few hundred yards farther to the N. E. in the same belt is the Patterson bank. The excavation made here has fallen in to such an extent that I could not see the occurence of the ore. All of these deposits are in clay, and no rock in place is visible in their vicinity. About 400 yards to the N. E. of this last is the McClung bank. This is nearer than any other to the Potsdam quartzite. I did not visit it, as I was told that the opening had caved in so much that the ore is concealed. The prospect for ore on this line of deposits is very good, and the deposits are near to the railroad, to which the ore can be easily brought.

The ore that comes next in order is that shown at several points near Irish creek.

It will be remembered that in giving some account of the Primodial strata to the west of Campbell's saw mill on Irish creek, it was stated that a deposit of ore occurs in a heavy mass of quartzite, the deposit being called locally the Mine bank. To distinguish this from the other Mine bank on South river this must be called

The Mine Bank of Irish Creek.—This is situated about 3 miles from Campbell's saw mill, in a direction a little S. of W. The ore occurs apparently in a cracked portion of the Potsdam quartzite. The amount is not large as shown at the place seen by me. Perhaps as much as a foot of solid ore occurs, but a good deal of it is found impregnating the crevices. It occurs just as does the Mike knob and the Dogwood hollow ore. The physical appearance of this ore is peculiar. It is the darkest ore that I have seen at all in the Primordial deposits. Some of it is pitch-black, and all has a varnished appearance. This dark color and glossy look seem to be quite common in the ores that occur in or immediately under the Potsdam quartzite, and especially in those that occur filling or impregnating broken portions of the rock. Analysis shows that in the amount of phosphorus this ore resembles the Mike Knob ore. It has, of metalic iron 58 per cent, of metalic manganese 2.4 per cent, and of phosphorus 1 per cent. It will be noted that only in exceptional cases are these dark glossy ores low in phosphorus. —This deposit is 2½ miles from the S. V. RR.

Craig Ridge Ore.—This deposit of ore lies about ¾ of a mile S. W. of the last mentioned dark ore. It occurs in the S. W. end of Craig ridge, and on the head waters of Craig creek. This deposit is found in a massive quartzite, which is either the Potsdam quartzite or the upper part of the flags of No. 4, where these pass into the quartzite. This deposit appears to be a stratum of the flags interbeded with the rest, and impregnated with iron ore. Most of the ledge is a rather lean silicious and shaly ore, but a considerable amount of good material is present. The ore is not so dark and glossy as is usual when it occurs at this horizon. It is for the most part yellowish brown in color. The ledge is about 8′ wide.

Kinnear Dark Ore.—About 5 miles below Alexander Grant's place on Irish creek, at the foot of Kinnear mountain, a graded path leaves the road and passes for about 2 miles over the S. E. face of the mountain up to the Kinnear bank, which is situated on the crest of the mountain. Some distance from the foot of this mountain, and some 100 yards from the path on the right hand in ascending, there is a deposit of dark ore, much like the Mike Knob ore. This ore apparently occurs in No. 4, and is associated with a massive sandstone that forms a wall-rock for the material. It occurs largely as an impregnation of the sandstone or quartzite, probably a disturbed portion of it. A good deal of this ore is dense and heavy, free from earthy impurities, and dark in color. Some of it is nearly black. It has the glossy or varnished look so common in the ores occuring as this does. I am not sure as to the identity of this ore. In its mode of occurence it is like the Craig Mountain ore, while in its physical character it is like the ore of the Mine bank of Irish creek. It does not, however, display near so much massive quartzite as these two deposits. A seam of pretty solid ore 4′–6′ thick occurs here, while a much greater thickness occurs in the form of rock impregnated with ore. The analysis of it shows of metalic iron 36.4 per cent, of metalic manganese 10 per cent. The phosphorus is returned as "much." It probably ranges as does that of the other similar ores from .9–1 per cent.

Kinnear or Graham Bank.--This is situated on the top of Kinnear mountain, a little west of the crest which is composed of the Potsdam quartzite. The ore occurs in the Ferriferous shales of the Potsdam, close over if not in the top of the Potsdam quartzite. It appears to occur forming irregu-

ar masses, or a sort of bed in clay. A large part of the ore is very dense, heavy, and free from earthy impurities. It is mostly of a chestnut brown color, and some of it has a peculiar glossy character and resinous lustre. Much of the ore, however, is mingled with more or less of lumps of white clay or shale, which appears to have been imbeded in the material during the process of collecting it by concretionary action from the clay. There seems to be a very large amount of ore at this place, but none of it has been, so far as I know, removed and used. Some of it was selected for analysis. As the deposit from which the samples were taken contains a stratum of Dufrenite, it might be supposed that they contain a large amount of phosphorus. What seemed to be an average ore was selected, and a specimen of it gave an analysis of metalic iron 60 per cent, and of phosphorus 1. per cent. A specimen of what seemed to be the best ore gave 61 per cent of metalic iron, and .5 per cent of phosphorus. The high percentage of iron in these ores indicates that they have undergone some dehydration.

The Deposit of Dufrenite at this place is quite interesting, and throws some light on the mode of formation of the deposit of iron in which it occurs. This mineral is shown in the principal pit opened here for the iron ore. This pit displays a mass of limonite about 12′ thick, resting on yellowish clay, which may be merely a parting in the bed, and not the true base, as the opening does not penetrate it. Not far below the surface of the ore, on the west side, the dufrenite appears forming a layer or parting about 12″ thick. It dips slightly to the S. E., and sometimes swells out to the thickness of 18″. It is thus a layer within the mass of limonite, but is sharply distinct from the iron ore, and does not blend with it at the surfaces of contact. This layer is composed of broad shallow shells united by their edges so as to form a continuous sheet, just as would occur if a number of shallow saucers were united by their edges. We thus see a series of swellings or convex surfaces on one side of the sheet, with corresponding concavities on the opposite side. The shells are usually under 3″ in thickness, hence there are several sheets laid together to form the stratum. Each shell is composed of fibres that diverge slightly from the concave sides towards the convex sides. The structure is plainly concretionary, which indicates a like origin for the iron ore, as indeed is abundantly shown in the structure of the ore. As there seems to be a large amount of this material it may possibly in the future be utilized as a source of phosphorus.

Buena Vista Ore Deposits.—These deposits are situated on North river near the mouth of the South river of the James and about 7 miles east of Lexington. These ore beds have been worked constantly since the time of the Revolutionary war. Up to the late war the ore was smelted at this place, but during the war the furnace was burnt down and has not been rebuilt. The ore, since that time, has been transported by canal, and smelted in a furnace situated just below Rope Ferry on James river.

Before describing the ore beds a short account must be given of the geology, as there are some points worthy of note not mentioned before.

A belt about ½ of a mile wide intervenes between the principal workings and the Potsdam quartzite mountain ridge, which here as elsewhere overlooks the Ferriferous shales and the Calciferous strata lying to the N. W. This belt is mostly comparatively low and undulating. That portion of it near to and around the ore pits is alluvial, and the earth to varying depths is composed of distinctly beded strata. But farther S. E., towards the mountain as the surface rises, the ground is composed of the usual clay formed in place by the decomposition of shales. Here the surface for some little depth is composed of material shifted in position by surface action. Two streams on the property called respectively Big Chalk Mine run and Little Chalk Mine run, give tolerable exposures of the geological structure. Big Chalk run, as we may call it for brevity, has cut pretty deeply into the strata for some distance above the ore pits. On passing up this run it may be clearly seen that its banks are cut in stratified material. Much of the clay both in this and the other run, is white and chalky in appearance, and hence the names. It is really an impure Kaolin, sometimes handsomely marbled and spotted with yellow and red colors. The clay is often very fine in texture, and quite plastic. I have no doubt that if they were sought for, valuable clays would be found here. At one point we may see on this stream a perpendicular bank about 50′ high, composed of stratified clay. The beds appear to dip about 15° to the S. E. Most of the clay is yellowish, but is mottled and streaked with bluish, white, lead colored or redish clay.

The various colors are mingled with the yellow clay, as if they were caused by particles and masses of clay, that had been torn off from beds of clay of that color. This is certainly the origin of some of the spots of colored clay distributed in the yellow mass. I conclude that this deposit is comparatively recent, and that it was formed by the erosion of the Ferriferous shales and Calciferous strata. We may recognize angular or rounded lumps and masses of various clays, and of a yellowish kaolin shale, that clearly comes from the Potsdam formation. In the bed of Little Chalk run we may see a similar state of things. Here we sometimes find in the predominant yellowish clay, lumps and masses of a deep purple-red clay, that is sharply distinct from the enclosing material. Little Chalk run gives a section nearly at right angles to the strike of the strata, and I made an examination up this run as far as the Potsdam quartzite mountain. Passing up this stream for some distance and to the S. E. of the ore pits, we find the ground rising into a high hill on the left of the stream. The face of this hill presented to the stream is an abrupt bare bluff nearly perpendicular, and 80′–100′ high. It is brought into this condition by extensive slides, and the locality is known as the "Big .slide." At this point there is an excellent exposure of the strata. As this point lies far to the S. E. of nearly all the known ore deposits on the Buena Vista property, I was much surprised to find the out-croping rock to be the impure limestone of the lowest Calciferous. It would follow from this that the Buena Vista ores do not occur in the Ferriferous shales, as do most of the important ore beds west of the quartzite, but in the shales of the Calciferous corresponding to the ochreous shales shown at Waynesboro. Owing to the decomposed and disturbed condition of the limestone, its dip could not with certainty be made out so far as the amount is concerned. It appears to dip to the W. N. W. ubout 45°. The ground is concealed for about 250 yards, and covered with fragments of the Potsdam quartzite that are sent down in immense numbers from Chimney Rock mountain. This latter is the most westerly of the ridges of the Blue Ridge, and is composed of immense masses of the Potsdam quartzite. This rock is here shown in place, and rises in great masses into the mountain, forming in one place a conspicuous bare crag called Chimney Rock. The quartzite is very massively beded, and is pure silica. It is cut by numerous joint-planes, the most conspicuous of which dips S. E., and sometimes obscure the beding. Other points are nearly vertical, and cause the rock to break up into numerous angular fragments. Severe local twists and flexures sometimes occur that roll the strata into barrel shapes. Most of the quartzite is pale pinkish in color. In certain bands the Scolithus markings are numerous and distinct. They were of great assistance in determining the dip. The dip is about 80° to the N. W., but in some places the rocks stand at an angle of 85°.

(To be continued.)

Notes on the Geology of West Virginia.

The Geology of Cheat River Cañon in Preston and Monongalia Counties.

By I. C. White, Prof. of Geol. and Nat. Hist., W. Va. University.

(Continued from page 54.)

The *Lower Coal measures* shoot into the air on Chestnut ridge, but arching over, come down into this Preston county syncline, with 200 to 300 feet of the *Barrens* on top of them, so that at the mouth of Sandy creek, the *Upper Freeport coal* comes into the immediate river hills. Sandy creek flows down the centre of the syncline from the east, removing a large portion of the *Barrens*, and near its mouth cutting a wide gap in the *Lower Coal measures*, and a narrow gorge through No. XII.

In the same way, Bull run flows down the central line of the syncline from the west, emptying into Cheat one-half mile below the mouth of Sandy. It, too, has eroded a large hole from the *Lower Coal measures*, but on cuting down to No. XII is suddenly arrested, and flows along on its top for nearly a mile until approaching the river, it cuts through the massive beds of that series, in several great cascades, giving splendid exposures of the rocks.

In descending the mountain from Mrs. Spurgeon's (opposite the mouth of Sandy creek), to Bull run, and thence down that stream to Cheat river, the following section (10) was constructed:

1.	Upper Mahoning Sandstone, massive, visible	20′	
2.	Concealed (spring at 50′)	90′	
3.	*Upper Freeport Coal* — coal, slaty....1′ 0″; coal, good....2′ 0″; shale, ...0′ 3″; coal.....1′ 6″; shale.....1′ 0″; coal, good....1′ 6″	7′	Lower Coal Measures.
4.	Concealed	10′	264′
5.	*Upper Freeport limestone*	12′	
6.	Concealed	75′	
7.	Sandstone, massive, visible (Freeport)	10′	
8.	Concealed	90′	
9.	*Coal blossom* (Kittanning Lower)	—	
10.	Shales, containing "kidney" iron ore	10′	
11.	Concealed and sandy shales	50′	
12.	Sandstone, flagy and massive	30′	No. XII. 194′
13.	Massive sandstone, pebbly	60′	
14.	Very pebbly bed	5′	
15.	Massive sandstone, scattering pebbles	65′	
16.	Shales, dark, containing fossil plants	10′	
17.	*Coal. Quakertown ?* — coal.....10″; shale.....3″; coal.....5″	1′ 6″	
18.	Fire clay	7′	
19.	Black, fissile slate	15′	
20.	Concealed	90′	
21.	Shales, redish	35′	
22.	Sandstone, rather massive, greenish	35′	
23.	Concealed, with occasional outcrop of green, flagy sandstone to level of Cheat river at mouth of Bull run (960 A. T. Bar.)	65′	

The structure of the Upper *Freeport coal* and *limestone* as given above, was obtained at a new opening on the road which crosses Bull run above Swindler's mill, and leads southward. The coal has been mined on the land of Mrs. Spurgeon in the immediate line of the section, but the opening had fallen in when I visited the locality, and the coal could not be seen. The coal is pitchy black with a resinous lustre, is rather free from pyrite, and has every physical appearance of a good coking coal. The central bench just below the 3″ shale, is not so good as the rest of the bed, being somewhat slaty on the outcrop.

The Upper Freeport limestone is fully exposed in the ravine below the coal, and seems pure throughout, being light gray, very compact, and breaking with a sharp clean fracture. It contains a minute, *univalve fossil.*

The basal portion only of the Freeport sandstone (No. 7) is visible; it is a coarse, grayish-white, micaceous sand rock specked with ferric oxide, and very much resembles the same bed in Western Pennsylvania.

The great sand-rocks of No. XII are completely exposed at this locality, and as will be seen from the section contain *no coal* until we come down to the *Quakertown horizon* and *Homewood sandstone* having merged with the underlying beds, thus shuting out the *Mercer coal and shale series* at this locality, and giving us 160′ of rock in one solid mass.

The little coal bed, No. 17, is identical with that given in Sec. 2, at the mouth of Quarry run, and here, as there, is also double, and underlain by a large bed of black slate. The coal is quite pure, and contains much mineral charcoal. In the dark shales above it, were seen some fragments of *Cordaites* and *leaves of Lepidodendron.*

In the section of Quarry run, 35′ more of No. XII, principally massive grayish-white sandstones, occur below this coal, but here, on Bull run, everything is concealed at this horizon, and the character of the intervening rocks can only be conjectured. The topography would make them *shales*, and hence I think it probable that the sand rocks seen at Quarry run are absent here, and that the *black slate*, No. 19 rests immediately upon the *Mauch Chunk beds*, but should it prove otherwise, the base of No. XII would then be found about 30′ below the top of No. 20, thus making the entire thickness of this series 225′ instead of 194′ as given in the section.

The top of the *Mountain limestone* must lie about 100′ below the level of Cheat river at this locality, where the centre of the syncline crosses.

At the mouth of Sandy creek, a massive, bluish-gray sandstone makes a bold cliff along the water's edge at 975′ A. T. (B.), and 220′ below the base of No. XII.

As we pass up the river southwards from the mouth of Sandy, the rocks begin to rise in that direction, and at one mile and a half above, the *Mountain limestone* has completely emerged from the bed of the river, revealing the following structure along a steep ravine which puts into the west bank of Cheat (Sec. 11):

1.	Gray sandstone, somewhat massive	20′	Mauch Chunk. 220′
2.	Flagy sandstone and sandy shales	150′	
3.	*Limestone* impure	10′	
4.	Concealed and green sandy shales	30′	
5.	*Red shale*	10′	
6.	*Limestone*, massive, gray	40′	Mountain Limest'ne 94′
7.	Blue shale and impure limestone	4′	
8.	Shaly *limestone*	5′	
9.	Gray, calcareous shale	2′	
10.	*Limestone* in massive beds, 1′—5′ thick	40′	
11.	Green shale	1′	
12.	Red shale	2′	
13.	*Silicious Limestone* — sandy limestone 2′; blue limestone, rather pure 2′; silicious limestone, passing gradually into sandstone below 2′	8′	
14.	Gray sandstone (Pocono) to level of Cheat	10′	

This section is valuable, because it gives the first complete exposure that we have had between the *Mountain limestone*

and the "*Silicious*" beds, showing them separated here by 3′ of red and green shales, and thus allying the "*Silicious limestone*" more closely with the Pocono sandstone into which it passes by insensible gradations.

In continuing on up the river from this locality, the rocks still rise to the southeast, though not much faster than the bed of Cheat, since its fall is very rapid over this portion of its course.

In the vicinity of the "Great falls," four miles above the mouth of Sandy creek, the west wall of the cañon, caped at top by the sandstones of XII, become almost vertical, and give a very complete exposure of the rocks as shown in the following section (No. 12) obtained there :

1. Flagy sandstone and concealed	25′	
2. Massive sandstone, top of *Homewood*	25′	No. XII. 220′
3. Concealed	90′	
4. Sandstone, very massive, pebbly	50′	
5. Sandstone, grayish white, somewhat flagy	55′	
6. Green shales	15′	Mauch Chunk. 295′
7. Concealed with blossom of *coal*	10′	
8. Green shales and sandstone	130′	
9. Sandstone, somewhat massive	25′	
10. Greenish, flagy sandstones	135′	
11. Limestone and red shale	25′	Mountain Limest'ne 120′.
12. Limestone	65′	
13. Limestone, interstratified with red shale	20′	
14. Red shale	10′	
15. "Silicious limestone"	35′	
16. Sandstone, massive, *Pocono*, to level of Cheat river, at Great falls (1055′ A. T. Bar)	50′	

No. XII is here 220′ thick, or nearly 50′ greater than at Quarry run in Sec. 2, and it is possible that it should also include the 25′ of flagy sandstone at the top of the section.

Small chunks of *coal* were seen mingled with other debris in the concealed interval, No. 7, and if they belong there, the bed would be in the Mauch Chunk shale, for No. 6, above, is unquestionably Sub-carboniferous.

The "Silicious limestone" attains a thickness of 35′ at this locality, and even then it is doubtful if I have carried it down far enough, since 10′–15′ more of the underlying sandstone possesses a very limy aspect in the great cliff which rises perpendicularly from the river at the Falls The whole stratum is one solid mass from the top of No. 15 down to river level, the Silicious limestone, as well as the sandstone below exhibiting current beding.

The "Falls" at this locality is a very rapid descent of the river for several rods over the massive portion of the Pocono sandstone, the stream descending about 10′ in as many rods.

The following section (13) was obtained about 300 yards above the Falls, in descending a timber chute where the logs in their rapid descent have removed the surface debris from several localities on the west bank of the river :

1. *Upper Freeport Coal*, reported	7′	
2. Concealed	200′	
4. Sandstone, massive, top of XII	50′	No. XII. 225′
5. Concealed	175′	
6. *Red shale*	10′	
7. Sandstone, flagy greenish	40′	
8. Sandstone, coarse, buff	3′	
9. *Red shale with iron ore nodules*	10′	
10. Sandstone, green, flagy, visible	50′	
11. Concealed to level of Cheat river	320′	

The Upper Freeport coal given in this section, has been opened along the road on the land of Mr. Graham, about one mile south-west from the top of the river bluff at No. 3, so that the interval of 200′ between the coal and No. XII, given by the barometer, should very probably be increased by 50′–75′, since the beds decline in that direction (S. W.).

As we pass on south-eastward up Cheat river from the Falls, the rocks still continue rising gently for about two miles, when they turn over in the broad arch of Laurel Hill, and descend, carrying the limestones and shales of No. XI below river level, and finally submerging No. XII itself at Albright, in the centre of the trough, where the western bluff of the river reveals the following section (14) of the *Lower Coal Measures :*

1. Sandstone, somewhat massive, Mahoning ?	30′
2. Concealed	55′
3. Shale, drab	15′
4. Sandstone	2′
5. Shale and fireclay	8′
6. Shale, green, sandy	10′
7. Sandstone, gray, massive, *Freeport*	30′
8. Shale, drab	15′
9. " dark blue	8′
10. *Coal, Middle Kittanning (Darlington)*	2′-3′
11. Concealed	5′
12. Limestone, nodular, (*Johnstown cement bed*)	2′
13. Concealed	23′
14. Sandy shale	7′
15. Sandstone, greenish	13′
16. Shale, visible	5′
17. Concealed to level of Cheat river at Albright bridge (1200′ A. T. Bar.), and to top of No. XII, here in bed of river	25′
Total height of section	255′

From the thickness of the measures in the above section, it would seem that the *Upper Freeport coal* should be looked for immediately under the base of No. 1, which according to this indentification would be the *Lower Mahoning sandstone*, but still it is possible that the *Lower coal measures* are here thicker than usual on Cheat river, and in that even the *Upper Freeport coal* would overshoot the top of this section.

No. 7 is undoubtedly the representative of the *Freeport sandstone* of Pennsylvania, while the coal of No. 10, would seem to be the *Middle Kittanning*, or *Darlington bed* of Western Pennsylvania, if Mr. Franklin Platt's identification of the latter with the coal overlying the *Johnstown cement bed* be correct; for the coal in question is here underlain by a grayish, nodular limestone that would well represent the "*cement bed.*"

The coal is quite good and has been gouged out of the the hill to the depth of a few feet for more than half a mile in the vicinity of Albright's bridge, its rapid dip into the hill preventing systematic mining.

Just above the bridge, the *Homewood sandstone* rises from the bed of the river and makes a bold cliff along the north-eastern bank, revealing under it a small *coal bed* beneath a few feet of shales.

Above this to the south-east, the other members of No. XII. come up, and make the steep north-west slope of Briery mountain.

I shall close this paper with a single suggestion in regard to the parallelism of the beds along the Cheat river that I have included under the name *Mauch Chunk shale.*

A review of the sections will show that this interval, extending from the base of XII down to the top of the *Mountain limestone*, has a thickness of about 300′, and can be subdivided into three well marked groups: 1st, at top, a *shale interval* often containing *iron ore* and one or more thin *red beds*, thickness 30′—50′; 2d, a series of flagy, green sandstone, often having quite a massive bed near the top,

and sometimes containing *calcareous bands* 1′–2′ thick, thickness 165′; 3d, a series of red and green shales in which usually occur one or more thin beds of impure limestone; thickness down to the main mass of *Mountain limestone*, 80′–100′.

Those who have read my summary of the Geology of Crawford and Erie counties, Pa., in Report Q⁴, will recall that I there show the "Cuyahoga shale," of Dr. Newberry to be a very composite series, having a structure somewhat as follows, begining with the base of XII, and descending to the *Berea grit* (Corry sandstone):

Shenango shales	35′–50′
Shenango sandstone	25′
Meadeville Upper shales	20′
" " Limestone	1′
" Lower shales	45′–55′
Sharpsville Upper sandstone	50′
Meadeville Lower limestone	2′
Sharpsville Lower sandstone	12′
Orangeville shales	75′
Berea Grit	—
Total average of thickness about	280′

The above succession, I have traced southward from Crawford county to the mouth of Beaver river at the Ohio, more than half way to Cheat river, and in oil borings at Beaver falls, Smith's ferry and other localities, the series is still 270′–280′ thick.

As is well known, the geologists of the 2d Geological Survey of Pennsylvania, who have studied the *Sub-conglomerate measures* in the western counties, have all heretofore placed the dividing line between XI and X, in the *Shenango shales*, and regarded the massive sandstone below them as the begining of the *Ponoco*.

It will be seen at a glance that the "Mauch Chunk shale" interval on Cheat river has a striking stratigraphical resemblance to the "Cuyahoga series, in Western Pennsylvania, a shale interval at the top and bottom with an intervening sandstone interval—Shenango—Sharpsville Lower—of practically the same thickness in each case. The query here suggested is, can the "*Mauch Chunk shale*" interval, 300′ thick on Cheat river in Monongalia and Preston counties, be identical with the "*Cuyahoga shale*" series as given above from the Ohio line counties in Pennsylvania? The answer is yet quite doubtful, but the only evidence obtained at present, seems to point to an affirmative reply.

Stratigraphy gives an answer decidedly in the affirmative, for the succession in each case is practically the same, and yet we must not forget that the nearest points to which the series has been traced—mouths of Beaver and Cheat rivers—are separated by some 60 miles, in which these beds are buried from sight by the overlying Coal measures. It should be stated, however, that the lithology of the 165′ sandstone series on Cheat river is often strikingly like that of the *Sharpsville beds* in Pennsylvania, and also that it sometimes contains, near its top, a massive brown sandstone that would correlate well with the *Shenango SS.*

But what say the *fossils* to this supposed parallelism?

On Cheat the "*Mauch Chunk beds*" are not fossiliferous, so that we cannot compare them directly in this respect.

The "*Cuyahoga*" *beds* are often quite fossiliferous, however, and the evidence that they furnish is curious, as showing an apparent contradiction in the answer to our query given by two classes of organisms—Mollusks and Fishes.

The *Meadeville limestones* in the "*Cuyahoga*" *beds* are in Crawford county, filled with remains of fishes, scales, bones, teeth, dermal structures, &c., and in the spring of 1880 I sent some of these fossils to Prof. Worthen, the eminent Palicthyologist of Illinois, for his opinion as to their geological horizon. He replied that they seemed to him to belong unquestionably with the *fish beds* of the *Chester limestone* at the West, and I should add that this remark of Prof. Worthen first suggested to me the possibility of an identity between the "*Mauch Chunk shales*" of Cheat river, and the "*Cuyahoga*" *series.*

The Molluscan remains found in the "Cuyahoga" series, however, seem to ally them more closely with the Waverly sandstones (Pocono), which underlie the shales and limestones of No. XI, and in my Report on Crawford and Erie preference was given to their side of the story. It now seems possible, as suggested above, that the testimony of the fishes may yet have to be received in preference to that of their more lowly cousins, the mollusks, and the "Cuyahoga shales" of Newberry, relegated to the horizon of No. XI, where they were long ago placed by Prof. Lesley on general stratigraphical grounds, (see his scheme of Ohio and Pennsylvania formations correlated in Report I, 2nd Geol. Sur. Pa.).

The apparent contradiction in the evidence given by the two classes of organisms may be satisfactorily explained, when it is remembered that the open sea in which the great Mountain limestone of Cheat river—the Chester, St. Louis, and other beds of the West—accumulated, shoaled away to a beach line of muddy shallows in Eastern Ohio and Western Pennsylvania, similar in every respect to the Waverly and Pocono beaches that had preceded them, and consequently we should expect to find the life forms that had inhabited the latter, continuing on with but slight changes up into the edges of the Mauch Chunk series, where overlaping the *Mountain limestone* it practically continued the Pocono beaches on to the close of the Subcarboniferous epoch.

The Forests of West Virginia

Written for *The Virginias* by Prof. S. P. Sharples, Expert Special Agent of 10th Census.

On refering to the Forestry map of West Virginia, which forms part of Bulletin No. 25 of the Forestry series of the 10th census, it will be found that a large portion of the southern and eastern parts of that state is colored green, thus showing that the forest covering is still, to a large extent, standing.

This forest portion of the state forms what was known in the early part of this century as the "wild lands of Virginia." It is a rough mountainous country with steep hill sides and deep narrow valleys with little flat or even workable land. The streams are mostly mountain torrents. It is almost entirely without means of transportation other than that furnished by heavy wagons traveling over the worst roads that I have ever met with, roads that are practically impassible in many places except on horseback.

This region is drained on the north by the Monongahela and its tributaries, chief among which is Cheat river. The Potomac also takes its rise in the same region as the Cheat. The southern portion is drained by the Great Kanawha and its branches, the chief of which, flowing in from the north, are the Greenbrier, the Gauley, and the Elk; Coal river flows into the Kanawha from the south.

The southern part of the state is also drained by the Guyandot and Big Sandy rivers. All these streams flow in comparatively narrow valleys with but limited flood plains. So deeply have many of these streams eroded their valleys that in many places these valleys have the appearance of deep cañons; this is notably the case with the upper or New river valley of the Kanawha. For many miles this river is a narrow torrent down which it is impossible to float logs. It is said that when it has been tried that the logs by the time

they reached the falls were worn out. Part of the course of Cheat river has, I am informed, the same character.

The forests of the state vary very much with the locality, or rather with the geological formations and the elevation. The upper and middle coal measures which underlie the western part of the state are covered with a luxuriant growth of timber, which extends in many places to the very tops of the ridges, changing somewhat in character with the exposure and elevation. Along the streams the red or river birch (Betula nigra,) and white elm (Ulmus Americana) are common; and grow in many cases to a large size.

Following these and runing for a considerable distance into the coves, there is a mixed growth of tulip-poplar (Liriodendron tulipifera,) which is here the finest tree of the forest; growing with this are many fine buckeyes (Aesculus flava,) and magnolias or cucumber tree, (Magnolia acuminata.) In many places this belt is interspersed with groves of sycamores (Platanus occidentalis,) and, wherever the exposure is right, the hemlock (Tsuga Canadensis) grows luxuriantly. Next succeeding this belt comes the white oak (Quercus alba,) which attains on the coal measures a growth and luxuriance rarely seen elsewhere. Growing at about the same elevation are many noble beeches.

Last year there was a very heavy frost, late in the spring, on the lower Kanawha, after the beeches had put out their leaves,—it killed the leaves in all exposed situations, and the trees did not recover from its effects during the growing season,though they made a feeble effort to put forth a fresh crop of leaves. These were not more than one-tenth of the proper size, and it was easy to see, during the whole summer, the extent of the beech belt.

Along the tops of the ridges there is, in many places, a good growth of chestnut oak, red oak, and chestnut; while among the white oaks are many fine hickories (Carya alba, tomentosa, and porcina,) making in its entirety, a mixed forest of great value.

A large amount of timber has been destroyed by forest fires and the "deadenings," made for small farms—many of them by squaters; yet, in spite of all these causes, there are many tracts of magnificent forest still remaining. Tracts where poplar, that will square 2 feet for 60 feet in length, may be obtained, where the beech and the white oak have never been touched. This timber is generally in the coves, at the heads of small streams, and in other comparatively inaccessible localities, such as along the cañon of New river on the side opposite the railway.

As the Ohio river is approached the country becomes more level and offers better facilities for farming and grazing, transportation is also easier, and so we find the river counties almost destitute of merchantable timber, though there is still much woodland.

On the eastern edge of the coal measures, where the subcarboniferous shales and limestones crop out and form the high plateaus or mountain valleys in which the main rivers of the state take their rise, the spruce and pine forests of the north extend a long spur to the south. This belt of forest, extending nearly to the southern edge of the state, is remarkable not only for the size of its trees but also for the density of its forests. The black spruce (Picea nigra,) called here "yew pine" and "white spruce," furnishes a timber comparable in working qualities with the best white pine and superior to it in stiffness and strength. The white pine (Pinus strobus) is found covering a large area in Pocahontas and Greenbrier counties; and through all this region the hemlock is abundant. Extending along the eastern edge of the outcropings of the coal measures is a remarkable belt of wild cherry (Prunus serotina,) the common rum or bird cherry. Those who have been accustomed to see the miserable caterpillar-eaten specimens of this tree, common all over the north, can form but little idea of the splendid tree that is found growing in these forests; trees three and four feet over the stump and 60 feet without a limb are not uncommon. Along with this growth the sugar maple is also found in its prime, rivaling the cherry in size and surpassing it in abundance. Much of this cherry, maple, and spruce country is mountain meadows, where the soil is so damp that forest fires have had but little effect.

In this part af the state fine chances are still offered for experiments in forestry, The forest land is comparatively valueless, and large tracts can be obtained for a few dollars an acre, the land not being very favorably situated for farming, the squaters are not troublesome. Natural re-foresting takes place here with great rapidity. A good instance of this was seen in Tucker county, where a "deadening" of several hundred acres was made about 30 years ago. For some cause this was never utilized, and the trees were allowed to grow up again. The cherry trees on it are now six inches in diameter, from 50 to 60 feet high, and perfectly straight. Through this district cherry is the favorite wood for fencing.

Re-foresting is also going on on the coal measures. Here wherever the land is abandoned, white and black walnut and various oaks soon take possession. The large black walnut trees are becoming comparatively scarce, but a young growth is coming rapidly forward that will surpass in abundance the old one, and if reasonable care is taken to protect it this will furnish even better timber.

If some of the various railroad projects that have been suggested are carried out, the most of the forest land of this state will soon become quite accessible to market.

The Conoy Indians, from whom our river name Kanawha may have been derived, are mentioned by Albert Gallatin, in his Synopsis of the Indian Tribes of the U. S., in the Transaction of the American Antiquarian Society, published in 1836, in the following passages:

"*The Conoys* were either a tribe of the Nanticokes or intimately connected with them. Charles Thompson calls the nation Nanticokes or Conoys, but confounds them with the Tutelos. Mr. Heckwelder thinks the Conoys to be the same people with the Kanhawas, This last name is identical with that of the western river Kanhawa, and it might have been supposed that the Kanhawas were a tribe living on that river, and that called by the Five Nations, Cochnowas, which at the conference of Lancaster (1744) they said they had destroyed. But it seems certain that the Indians on the heads of the Potomac were called Ganawese and Canhawas. The Nanticokes and Conoys, being allies of the Six Nations, remained on the Susquehanna till the commencement of the war of the revolution, when they removed to the west and joined the British standard," (p. 52.)

"Heckewelder, speaking of Conoys, says, that they are the people we call Canais, Conoys, Canaways, Kanhawas, Canwese; and, in another place, that the Canai settled at a distance, on the shores of the Susquehanna and of the Potomac. Colden mentions, under the year 1677, Canagesse Indians, and in 1684, the Cahnawaas, meaning certainly the same people, as Indian friends of Virginia, against whom the Five Nations had commenced hostilities. Indians living on the Potomac, rather than on the Kanawha, must at that time have been under the protection of Virginia. And it is probable that the Nanticokes, the Susquehannocks, and the Conoys, Canawese, or Cahnawas, were but one nation, extending from the eastern shore of Maryland, across the bay, and north of the Potuxent to the upper waters of the Potomac." (p. 56.)

In the speech of Tachanoontia, a chief of the Six Nations,

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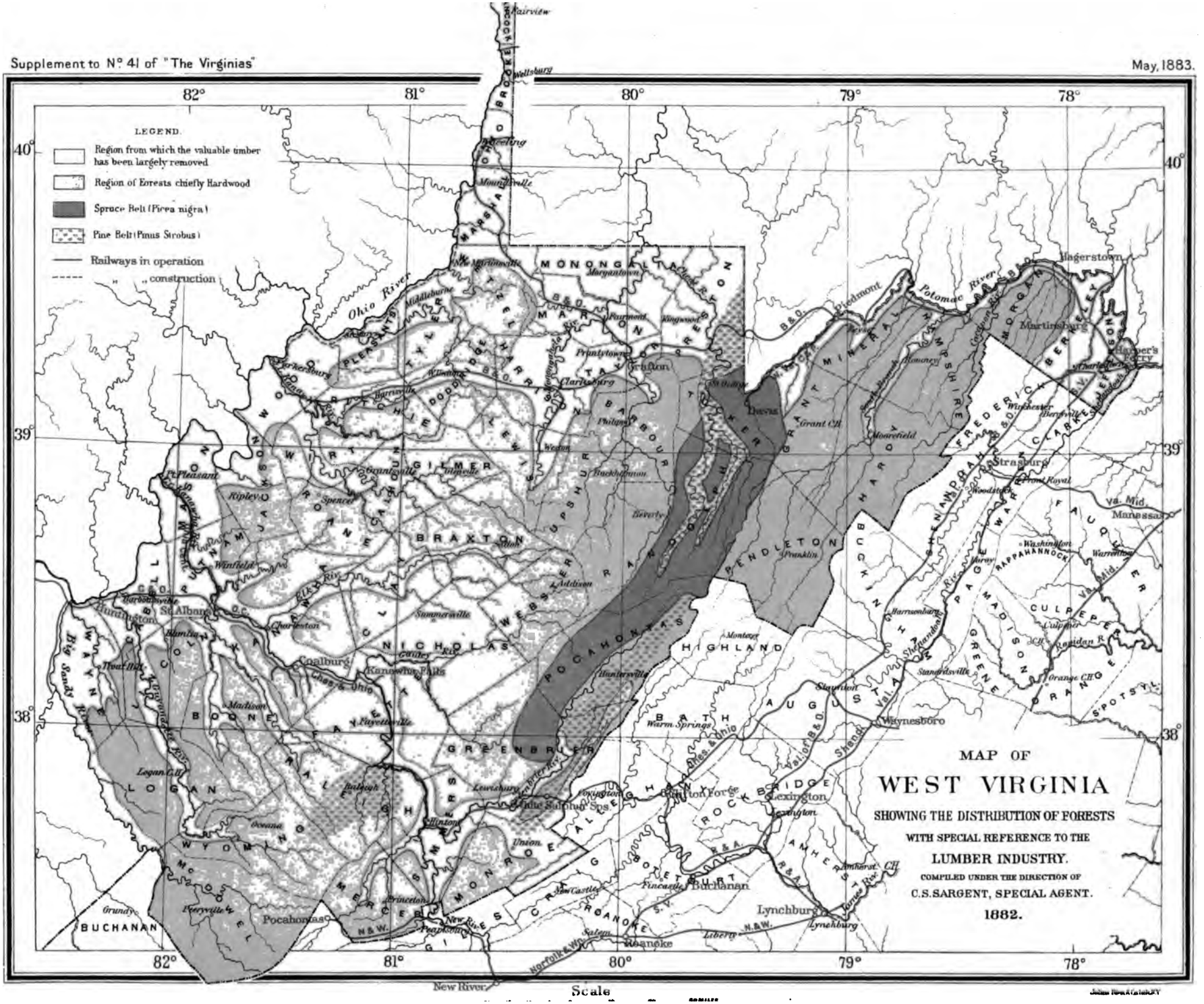

made in 1774, at Lancaster, Pa., during negotiations for a treaty, is this statement: "All the world knows we conquered the several nations living on Susquahannah, Cohongoronta (Potomac,) and on the back of the great mountains in Virginia; the *Conoyuch*-such-ronaw, the Cohnowas-ronow, the *Tohoairough*-roonaw, and the *Konnutskinough*-roonaw feel the effects of our conquests, being now a part our of nations, and their lands at our disposal."

In reference to the termination *roonaw* it is said to be the same as *ireni*, the Algonkin for "men," and in this connection means Indians speaking the Algonkin tongue.

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(Continued from page 68.)

been proven on the old Catawba furnace estate for some ten miles, along and some distance up the eastern slope of the North mountain; the ore bearing belt, nearly vertical, has a breadth of about 150 feet, and in this are ore strata from 6 to 10 feet thick.—The same belt has been traced farther to the southwest. (See structure of this range in section No. I,—also anthracite coal beds in No. X, there worked for local use.)

The visit to Gale mines of Rorer Iron Co. gives the members a fine view of the bottom lands of the Roanoke and of the rich agricultural region beyond, a common sight in every portion of the Great Valley of Va. from the Potomac to Tenn.

In this direction the Western Blue Ridge has been locally glaciated almost out of existence, only low ridges, like Mill mountain on the left, and rounded and pointed knobs remaining, but enough to hold up the great iron ore beds at most convenient levels for working. Beyond these knobs and ridges the eastern, Archaean or Primary Blue Ridge presents its deeply sculptured and highly picturesque horizon line.

The Gale mine enables one to see the character of the No. I (Potsdam) ores when disposed in a shallow syncline. The eastern outcrop, exposed in the open field on the iron knobs, shows one stratified bed of ore over 10 feet thick, and the same is seen where mining operations have cut it on the slope of the trough; other beds exist beneath this.—The same character of deposits have been opened at the Griffin, old Gale, Turner and Starkey mines a short distance to the southwest. On the westward slope of Poor mountain, the western Blue Ridge that appears again in the distance to the westward, on the right, these ores, similar in character and extent, have been developed at the Bott and other mines; section No. 2 shows the disposition of the ore-bearing rocks there.

Excursion to Flat-top, June 7th.

No. 4.—*N. & W. RR.: Roanoke to Pocahontas.*

Stations.	County and State.	Miles from Roanoke.	Feet above Tide.
Roanoke	Roanoke, Va.	0.00	912.8
Salem	" "	6.75	1,096.5
Big Spring	Montgomery, "	20.00	1,250.3
Shawsville	" "	23.00	1 267.9
Big Tunnel	" "	27.00	1,917.9
Christiansburg (sn)	" "	32.50	2,090.0
Central	" "	43.00	1,772.5
New River	Pulaski "	44.50	1,769.0
Churchwood	" "	50.00	1,769.0
Staytide	Giles "	58.50	1,613.0
Ripplemead	" "	61.50	1,610.0
Wenonah	" "	72.50	1,562.0
Narrows	" "	75.50	1,519.0
Adair	" "	79.50	
Glenlyn	Mercer, W. Va.	82.00	1,525.0
Oakvale	" "	89.00	
Ingleside	" "	102.00	1,940.0
Bluefield	" "	112.50	2,555.0
Graham	Tazewell, Va	115.00	2,390.0
Falls Mills	" "	118.50	2,328.0
Pocahontas	" "	125.00	2,315.0

Going from Roanoke to Pocahontas by the Norfolk & Western RR., the railway first follows Roanoke river to its forks near Big Spring; it then passes for some distance along the side of the lovely valley of the South fork of Roanoke, ascending to the watershed of Roanoke and New rivers—a mere divide in The Valley that is often foolishly called Alleghany mountain, because New river flows westwardly. Along this part of the route the Western Blue Ridge, as Poor mountain, is on the left, the railway at times runing near the junction of formations I and II. The ores of No. I have been developed all along the western flank of Poor mountain. Fort Lewis mountain rises to a bold height on the right.—The structure of this region is well shown in section No. 2, which crosses near Big Spring.—Eastward from Shawsville, in the Blue Ridge, are Alleghany Springs, noted for their chalybeate waters; and near Big Tunnel, on the right, are Montgomery White Sulphur Springs.

The Roanoke-Kanawha (New river) divide is crossed just beyond Big Tunnel, at an altitude of over 2,000 ft., and the plateau of New river, one that ranges in elevation from 1,600 to over 4,000 ft., is entered upon. From this divide the descent is quite rapid to New river; passing Bangs, the station for Christiansburg, the pleasant county seat of Montgomery county, which is on the left; in the same direction, in the Blue Ridge, is the Brush creek gold field. A few miles northwest, to the right, from Bangs, at Blacksburg, is the Virginia Agricultural and Mechanical College. Going down to New River Price mountain is seen on the right; this contains several beds of coal in formation No. X, the Vespertine.

New river, the Uper Kanawha, soon appears on the right, a noble stream that has come down for near a hundred miles from its head springs on Grandfather mountain in North Carolina, over a mile above the sea level.—Central (Lovely Mount is Uncle Sam's name for it) is the terminus of the New River branch of the N. & W., but that branch is not reached until New river is crossed and New River station (Perth, is is said, it is to be renamed, for no reason that we wot of) is reached, where a fine section of the Valley limestone, No. II, is exposed. Up the river from this point is the New River-Cripple Creek iron region, some of the pig iron from which is boated down to this point.

The New River branch turns northwestward and runs across The Valley—the fine grazing and timber lands of Pulaski, to the grand gorge that New river has trenched through all the Apalachian ranges. From just beyond Churchwood station on to Adair, is displayed one of the most interesting geologic and scenic sections in the country. All the formations from No. II to No. XI, from the Trenton up to the Umbral, inclusive, are these displayed, exhibiting numerous forms of stratigraphical arrangement.—Section No. 3 will aid in acquiring a knowledge of this region.

After an exciting run down New river, through and across the formations—passing numerous outcrops of Trenton (II) and Clinton (V) iron ores—the mouth of East river is reached, where the railway turns and runs with East River or Peters mountain, along a profoundly faulted valley in which the formations are wildly crushed together; this passed it turns down the Bluestone (named from the blue, No. II, limestone there exposed), and terminates at the eastern base of the Great Carboniferous escarpment, at Pocahontas.

Want of space forbids giving detailed information about the iron ores of the East River mountain chain, or of the Great Flat-top Coal field and the vast forests on and beyond it; the papers read before the Institute will supply this information.—We have only room for the station, distance, and altitude table from New River to Bristol, which appears on page 65.

The Eastward Traffic of the Norfolk & Western RR., for First Quarter of 1883, by origin and destination, in 2000 lbs. tons, has been kindly furnished *The Virginias* by Auditor E. E. Portlock : from those official statements we summarize the following facts :

1. *Live Stock.*

Cattle	2,279	Horses and mules	588
Hogs	250		
		Total	3,250

These were sent from 26 different stations of the road, but mainly from those of The Valley, the blue-grass country,—Bristol, Abingdon, Glade Spring, Marion, Dublin, and Christiansburg having been the most important shipment stations. Of this 749 tons were from beyond Bristol, from Tenn.—The destinations were to Shen. Valley, Va. Mid., and Richmond & Danville railways; to Lynchburg, Petersburg, Norfolk and way stations.

2. *Forest Products.*

Lumber	3,448	Wood	1,139
Logs	3,275		
Staves	3.170	Total	20,864

The above was sent from 40 different stations of the railway and from beyond Bristol.—The lumber was sent mainly from the Valley stations, from Wytheville to Bristol, from New River branch, and from Midland and Tidewater region stasions; it was destined to Baltimore, Philadelphia, New York, Boston, Richmond, Lynchburg, Petersburg and Norfolk, and to S. V., Va. M., and R. & D. railways; much of that from The Valley was black walnut and cherry, the latter from the Blue Ridge in N. C., shiped from Abingdon.—The logs were probably most of them black walnut, as they were sent from the limestone region of The Valley. These logs were destined mainly to Boston and New York.—The staves were mainly from beyond Bristol, from Bristol and Abingdon and from the New River branch, from the white oak regions, and destined chiefly to Norfolk, for shipment to the West Indies, etc.—Counting 5,000 ft. b. m. as 10 tons, the above movement was about 10,500,000 f t.

3. *Minerals and Metals.*

Lead, shot and bar	6	Zinc Spelter	222
Lead, pig	3	Cement and lime	308
Barytes	185	Marble	738
Manganese	100	Plaster	750
Copper and other ores	145	Slate and stone	115
Copper ingots	73	Salt	179
Iron ore	2,682	Coal	2,108
Pig iron	5.342		
		Total	13,307

The shot and bar and pig lead was from the Wythe Lead Works to Lynchburg and way stations; the barytes was from Marion, to Boston, New York, and Philadelphia; the manganese was from beyond Bristol to Norfolk and New York; the copper and other ore was from Buford and Prospect, to Philadelphia, Lynchburg and way stations, and the copper ingots were from Marion (from the Ore Knob works in N. C.) to New York. Of the iron ore 2,019 tons were from Cranberry, N. C., 643 from Ripplemead, Va., mines, and 20 from S. V. RR.; all of this (except 20 tons to Norfolk) went by S. V. RR. to Pa. furnaces.

The pig iron was from beyond Bristol, from Bristol, Abingdon, Crockett, Max Meadows, Dublin, New River, Christiansburg and Lynchburg. Of it 1,585 tons, that from Bristol and beyond and from Abingdon, came from Tenn.; 3,607 tons, that from Crockett, Max Meadows, Dublin, and New River, was from the Pulaski and Wythe county furnaces, on New River, Cripple creek, etc.; the 90 tons from Lynchburg was probably from the furnace there, and the 60 from Christiansburg was from Sinking Creek furnace, Giles county. This pig was sent to New York, Philadelphia, Baltimore, Shen. Val. RR., Lynchburg, Richmond, Petersburg and Norfolk; all that from Virginia was charcoal iron, suitable for car-weeels, etc.

The zinc spelter, all from the Bertha works at Martin, went to Boston, New York and Philadelphia; the cement and lime were from Saltville, from S. V. RR., R. & A. RR., Petersburg, Lynchburg, etc., mainly to local points; the marble was all from Tenn., except a few tons to and from way stations,—the Tenn. marble went to Boston, New York, and S. V. RR.; of the plaster 700 tons were sent from Saltville, where quarried, to way stations; the slate and stone shipments were mainly from Buford and Petersburg to way stations; the salt, except 21 tons of foreign, was from Saltville, where made, to way stations; and the coal was, from beyond Bristol (1,578 tons), Martin 30, Churchwood 10, New River (Flat-top) 83, and Christiansburg 239. All these but that from New River and Tenn., was No. X, or Vespertine coal.

The Minerals of Wythe Co., Va., Lead Mines.—At a meeting of the Association of Am. Geologists and Naturalists, held in Boston in 1842, Prof. Wm. B. Rogers mentioned that he had found the sulphuret of zinc sometimes, and the silicate (electric calamine) generally and very abundantly in the lead mines of Wythe county, Va. The latter mineral often occupying a great part of the breadth of the vein, lying for the most part beneath the lead ore, sometimes as a sub-crystaline mass and sometimes in groups of small radiating crystals. The sulphuret is chiefly met with in nests and thin veins, in the spary and magnesian limestone adjoining the lead ore, and intermixed with crystals and small seams of galena.—He added, as a fact of mineralogical interest, that besides the sulphuret of lead, these mines yield in some instances quite a large proportion of carbonate, of which beautifully pure crystaline specimens were by no means uncommon; and what is still more interesting, they furnish a considerable amount of red oxide or native minium, with a small proportion of yellow oxide, both of which have hitherto been regarded as very rare minerals. From its resemblance to ferruginous earth or clay, this red oxide was, until lately, regarded at the mines as worthless, but is now highly valued for its productiveness in metal.

The Washington & Western RR., extending 51 miles from Alexandria, Va., to Round Hill, near the eastern foot of the Blue Ridge, Loudoun county, Va., has recently been sold, under a decree of court, for $400,000, and the sale has been confirmed.—It is known that this purchase is in the interest of the Shenandoah Valley RR., which will at once proceed to extend it across the Blue Ridge to some point on its main line in Clarke county, and thus secure a direct line to Washington city and to the port of Alexandria, greatly to its advantage and to that of those cities.

This railway was chartered and begun as the Alexandria, Loudoun & Hampshire, to extend from Alexandria to the Potomac coal basin; it was changed to the Washington & Ohio; then to Washington & Western; and now it is said it may be named the Washington, Western & Ohio,—but that is doubtful.—It is more than probable that this road will be extended beyond the S. V. RR. by way of Winchester, westward to the Apalachian iron belts of Virginia and West Virginia and to the Potomac coal basin, connecting with the W. Va. Central & Pittsburg RR., as shown on the map in the May, 1882, No. of *The Virginias*.

Traffic of Shenandoah Valley RR., first quarter of 1883.

Auditor J. S. Coxe kindly furnishes *The Virginias* full statements of the shipments of lumber, cattle, minerals, etc. by the Shenandoah Valley RR. during the months of Jan., Feb., and March. 1883; the first quarter of the current year, in 2000 lbs tons. From these we have compiled the following.

1. *Minerals and Metals.*

	Tons.		Tons
Iron ore	3,469	Pig iron	2,027
Manganese	682	Blooms	417
Lime	1,464	Railway iron	883
Ochre	85		
		Total	9 025

The shipments of iron ore were from Dry Run, Milnes, Roanoke, Kimball, Ingham, Houston and Vesuvius stations of S. V. RR.; Ripplemead station of Norfolk & Western; and Cranberry, N. C. These ores were destined to Swartara, Bessemer, Johnstown, Harrisburg, Allentown, Mt. Union and Dunbar, Penn.; to Dover N. J. and some to stations on S. V. RR.—The Houston, Va., mines shiped 1,018 tons of manganiferous ore to the Cambria works, Johnstown, Pa.; and 1,262 tons of Cranberry, N. C., ore were taken to Allentown, Pa.

The manganese, except 36 tons from Vesuvius station, was from the Crimora mines, Augusta county, Va. It was sent to Pomeroy, Ohio, Pittsburg, Philadelphia, and Johnstown, Pa.; Jersey City, N. J.; Newport News, Va.; and Mason City, W. Va.

The ochre was from the Oxford mines, near Marksville station. It was sent to Rochester, Baltimore, Cleveland, Chicago, Evansville, Toledo, Cincinnati, Dayton and Detroit.

The lime was mainly from Riverton and Lime-Kiln stations to Richmond, Petersburg, Wakefield, Zuni, Norfolk, Mechum River, Lynchburg and Charlottesville, and local points, in Va.; and to Chambersburg, Pa., and Washington, D. C.

The pig iron and blooms (except 59 tons from Bristol, Tenn., and 30 from Roanoke, Va.,) were from the Shenandoah Iron-works, at Milnes station, to Philadelphia, Pottstown, Danville, Harrisburg, Altoona, Catasauqua, Limerick, Kensington, York, Swatara, Paschall, Haleyes, and Centreville, Pa.; Boston, Baltimore and Richmond; Gloucester, N. J.; and Wilmington and Newport, Del.

2. *Forest Products.*

	Tons.		Tons.
Lumber	4.431	Spokes, rough	1,748
Bark, ground	98	Ties; railway	2 439
Sumac	14		
		Total	8 730

Bark, rough.....900 cords.

These articles were shiped from nearly every station on the S. V. RR., showing the abundance of forest products along its line,—and to more than twenty markets in Va., Md., Pa., N. J. and N. Y. The movement of rough bark was mainly to local points, where tanneries have been established; the ground bark was from Front Royal, Riverton, Rileyville and Dry Run to Philadelphia, Pa., and Newark, N. J. The sumac was from Riverton to Huntingdon, Pa. Most of the rough spokes were sent to West Chester, Pa.

3. *Live Stock.*

	Car-loads.		Car-loads.
Cattle	151	Sheep	12
Horses	16		
Hogs	7	Total	186

Shipments of live stock were made from eighteen stations of this railway to Philadelphia, Baltimore, Trenton and numerous points in Pennsylvania.—This road is most favorably located for a large cattle carrying business.

These items foot up over 20,000 tons of freight. In most of them there is a handsome percentage of increase over the same quarter of 1882.

The Fire-and China-clay from the beds of the Virginia China-clay and Fire-brick Co., near Sherando station of Shenandoah Valley RR., Augusta county, Va., has recently been the subject of analysis by Dr. Henry Froehling, analytical chemist, Richmond, Va.; the result—No. 1 of the following table—he has kindly furnished *The Virginias*, adding Nos. 2, 3, 4 and 5 of analyses of Scioto, Ohio, clay, from Ohio Geol. Report of 1870; to which we have added Nos. 5 and 6 of clays from Woodland, Clearfield county, Pa., by Otto Wuth, from catalogue of Woodland Fire-brick Co.—The Virginia sample wae dried at 212° previous to analysis.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Silica	47.90	61.90	57.90	54.15	59.30	45.13	45.54
Alumina	39.86	22.80	26.60	23.30	24.10	37.51	38.57
Lime	0.23	0.05	0.25	1.25	0.80	0.29	0.45
Magnesia	0.19	0.70	0.60	trace	1.15	0.10	0.12
Potash and Soda	1.55	0.90	1.15	0.90	0.95	....	....
Water	9.85	....	....	....	....	15.61	14.91
Iron sesquioxide	0.24	....	....	...	....	0.15	0.13
Organic matter	....	....	....	....	....	0.21	0.18
	99.82	99.25	99.50	99.90	99.55	100.00	100.00

There was only a "trace of soda" in the Virginia clay.

Dr. Froehling comments on the Virginia clay:—"Theoretically it should make a good fire-brick for coke ovens which require a dense rather aluminous brick with little or no iron; in these respects it is far superior to the Scioto clay, the analyses of which are given in the Ohio report."

An additional interest is given to the above by the statements of Mr. Soldenhoff that the damage to his Coppee coke ovens, at Hawks-nest, on Ches. & Ohio Ry.—which he is now repairing—resulted from the highly silicious character of the American bricks that in his absence, were used in their construction, the brick in the flues having fused and choked them. Mr. S. thinks of importing bricks for his purposes. Of this, we assure him, there is no necessity. He has only to make known the character of the brick he requires and he will find that the Woodland, or the Virginia companies, above mentioned, or some other American fire-brick makers, will supply just the article needed;—and from what we hear of the coke made in these ovens the demand for such brick will probably be a large one.

Elk-Garden, W. Va. Coal.—At a recent meeting of the directors of the W. Va. Central & Pittsburg Ry., the president of that railway, Hon. H. G. Davis, announced that a coal department had been organized at the Baltimore office of the company, 57 Second St., with branch offices in New York and Boston. In this connection he stated that he had had the Elk Garden coal, which this company mines and ships, tested by the Navy Department at Washington, with the following satisfactory results:

Equipment Office, Navy-Yard,
Washington, April 13, 1883.

Commodore J. Pattison, Commandant:

I have the honor to report that the bituminous coal recently received from the West Virginia Central & Pittsburg Ry. Co. from their Elk-Garden (Big Vein) mines, has been

tried in the rolling mill, forge and machine shops for several days. We find that it burns freely, gives a strong, clear flame, and is remarkably free from slate and dirt, and leaves but little cinder. This coal is of excellent quality, and meets all the requirements of the shops in this department.

Very respectfully,
S. Casey, Commander U. S. N.,
Equipment Officer.

The Coke Controversy.

Reply of Prof. Dewey to Mr. Fulton.

To the Editor of *The Virginias.*

Dear Sir:—I have read Mr. Fulton's wordy and poetic communication to the *Keystone Courier* upon the subject of my letter to you published in the May number.

As frequently happens, when a person finds himself followed up and cornered by his own misstatements, Mr. Fulton has entirely dodged the square issue and expended himself upon unimportant side issues, and in raising distinctions which cannot be sustained.

To follow the points of my own letter rather than the attempted answer, why does not Mr. Fulton explain the stupendous blunder, first called attention to, of comparing percentages by weight with percentages by volume? Again, why does he say nothing about the discrepancy between the number of cubic centimeters in one cubic inch, and the number of cubic centimeters in his cubic inch of Alabama coke, in which an error of over 15 per cent occurs? Or is such an error but one of the trifles with which "we are met all through this brief article?"

The point of the order in cell space considered by itself is, at best, comparatively unimportant, and having shown, as I have, that the determinations of the cell space are vitiated by errors of over 15 per cent, its value sinks into insignificance; yet Mr. Fulton expends himself entirely upon this small point, utterly ignoring the point upon which everything else depends. Nevertheless, even on this point, small as it is, Mr. Fulton has fallen into a grave error, for I made no attempt whatever to "rank" the cokes in this table, but only to express their *relative* content of cells. The reason for introducing this point at all was simply as being one of the many exhibitions of the general looseness and crudity of this table; and it was not upon this point that the whole table was declared to be inaccurate, but upon the errors stated above.

As to the difference between a pore and a cell—which Mr. Fulton baldly asserts to exist—I would be glad if Mr. Fulton would kindly inform us in what the difference consists; and also, when he placed his pieces of coke in water under the receiver of the air pump and exhausted, how he induced the water to enter the cells and to keep out of the pores.

Again, Mr. Fulton asserts that a hard coke is a cellular coke and a soft coke is a porous coke; also that hardness assures its higher order of cellular space—but this is a mere assertion of his—and he brings nothing whatever to its support, nor can he do so.

I repeat, I do not wish to enter into the discussion of the relative values of the Connellsville and New River cokes, and the motive of my former letter was to guard against dependence being placed upon such worthless results as the table published by Mr. Fulton, or "impeach," if he chooses, the "method (or manner)," of the "physical tests used." I do not know at the present writing which is the better coke, but I do know that such results cannot be of the slightest assistance in settling the question.

Finally, I restate my original assertion in regard to this table. "I have said enough to demonstrate its entire lack of value, both on account of the want of care with which the experiments were conducted and the manner of making the calculations;" and this assertion being backed by an unanswered array of figures stands uncontroverted.

Yours very truly,
Fred. P. Dewey.

Washington, D. C., May 26, 1883.

The Future of West Virginia Coals.—*The American Manufacturer and Iron World*, of Pittsburg, Pa., of May 11, 1883, in its Trade Report on the Western coal market, it says:—"Prices remain without change—they are quoted down to the lowest paying rate for coal from the mines lying nearer the points of consumption.

These deposits are mainly in West Virginia and Alabama; and that the operators of them do not force prices lower, is owing to their lack of the requisite facilities for mining and transportation. When these are attained, and work can be carried on with the systematic skill that has been acquired by the long experience of the Pittsburg operators, prices will be likely to drop still lower.

The great region, where exhaustless quantity and superior quality exist, is that of West Virginia, which, as yet, has been but immaterially opened, and is without the facilities and experience needful to carry on successfully a wide-spread, complicated business like the coal trade. Time will remove these hindrances, and West Virginia, with her vast deposits of coal, will occupy a commanding position in all the markets of the great Valley and the Gulf;"—and it might have added in nearly all those of the Atlantic slope and seaboard.

Ex-Speaker, S. J. Randall, of Pennsylvania is reported by the Philadelphia Press as saying, after his recent visit to West Virginia to look after some coal lands there in which he is interested:—"I hate to see it because of state pride, but the Kanawha Valley of West Virginia will soon supply the West with coal instead of Pittsburg. I am told now that Huntington's Chesapeake & Ohio Ry. cannot begin to handle its freight. Capital is pouring into Virginia. Only recently a million of English capital has been invested there. Railroads are being built, and the rapid development of the state is phenomenal."

The Shenandoah Iron, etc., Co., at Milnes station, Shen. Valley RR., has its Gem and No. 2 blast furnaces, its forge, and its Fox-mountain, Kimball and Boyer iron ore mines, all in steady and successful operation. At these three mines from 150 to 160 men are employed, mining over 200 tons of ore daily.

Gem furnace had a fair run in April, making 1,635 tons of pig—an average of 54.5 tons a day—about evenly divided between grades 1, 2, and 3. To make this iron 2,589 tons of coke, 3,945 of ore and 2,043 of limestone were used; or 1.58 tons of coke, 2.41 of ore, and 1.25 tons of limestone were required to make one ton of pig.

Furnace No. 2 produced 211 tons of charcoal pig iron in April; using 21,525 bush. of charcoal, 520 tons of ore and 100 tons of limestone; or 102 bush. of charcoal, 2.46 tons of ore, and 0.47 of a ton of limestone to the ton of pig iron made. The Forge made 120 tons of charcoal bloom.

Within the past year this company has laid out about 40 acres in building lots, 50′ × 150′ in size, with avenues 70′ and streets 25′ wide; and more than 50 new houses stores, etc. were erected, and more are now in course of construction. It is now proposed to supply this thriving town with water brought 3 miles, in a pipe, from the Blue Ridge, where an ample supply of pure water can be had, with a head of over 300′.

A charter has been obtained for a Machine-works and Foundry Co., which it is expected will soon begin operations.

The Virginias.

No. 42. Vol. IV.—No. 6.

Staunton, Va., June, 1883.

Edited by - - Jed. Hotchkiss.

Table of Contents.

Excursions into the Virginias are now very popular in all parts of the Union, and our railways are disposed to encourage the laudable desires of the outsiders to see more of the many remarkable and attractive objects within the two great states of Virginia and West Virginia. One of the good and pleasant ways into and across these states, from the Atlantic to the Ohio, and to their noted summer resorts, grand scenery, mines, forests, etc., is by the Chesapeake & Ohio Ry., as we are reminded by the receipt of a well prepared pamphlet (which can be had at the offices of this Company in all the important cities) giving the details of 78 excursions, by cheap round-trip tickets, from within and without, to the springs, the caves, the mountains, the Natural Bridge, and other attractive points in the Virginias.—It is now but a half-day's ride from New York city to this the geographical centre of Virginia and West Virginia by the Louisville express of the Ches. & Ohio that daily leaves Washington, D. C., at 5:10 p. m.

The Iron Market.—Bradstreet's of June 30, says: For the first time in many weeks we have to chronicle a pronounced firmness in the p g iron market. There seems finally to have been a check to the ebbing of the tide in this market, and while it is yet too early to note a counter movement, there is that degree of added firmness in its present position which looks remarkably like the begining of a substantial improvement. It adds that qutoations are, nominally, $22 for No. 1 foundry, $20 for No. 2, and $19 for forge; but the best grades of American irons are even now commanding $22.50 and $23.

A Demand for Cheaper Ores.—In his inaugural address before the Roanoke, Virginia, meeting of the American Institute of Mining Engineers, President Robert W. Hunt made the following assertion: "We must have cheap raw materials. No matter how much engineering skill is exercised, no matter how economical the administration, no matter how low the reward of labor, unless the coal, the ore, the pig metal are obtained at a far lower price than we now know, our market must be limited to our own domain, and the foreign importer must be handicaped by an impost; or else our furnaces must remain cold, our mills idle, and the mines of either my own New York or those of hospitable Virginia lie undeveloped. To give us this cheap material, other than labor must be content with smaller returns. If the ore property is acquired for say $50,000, the company formed to develop it must not have a capital of a million, and each stockholder expect at least ten per cent on his watered investment. I fully appreciate that this is not likely to be received with favor; but if the demand is for steel rails at about $25 per ton, to meet it the manufacturer must have pig iron at the English price of say from $12 to $13. Then, with the American converter averaging 42,705 tons, against 20,920 for the English, and 15,001 tons for the French, per year, there need be no fear but the American product can compete in any market, and at the same time pay labor as American labor should be rewarded."

Virginia exports and imports in May, 1883.—From the May report of Hon. Jos. Nimmo jr., chief of U. S. bureau of statistics, we gather the following returns of values for Virginia ports in May, 1883.

Norfolk and Portsmouth:	
Exports of domestic merchandise	$1,123,897
Imports	4,357
Richmond:	
Exports of domestic merchandise	$ 72,649
Imports	52,292
Yorktown:	
Exports of domestic merchandise	$ 220,562

The Wheat harvest of Virginia that has been gathered in Tidewater, Midland and Piedmont Virginia during this month, and that will be fully gathered in the Valley, Blue Ridge and Apalachia during the early part of July, is, it is generally conceded, one of the largest that has ever been cut in the state. The season has been a "wheat" one, the weather moderately warm and moderately moist.

Sales of West Virginia lands are reported in many of our exchanges from that state. The *State Tribune*, of Charleston, says: Ten dollars an acre has been paid Wm. Lewis for 2,646 acres of land near the Kanawha Falls. These large transfers of real estate will bring money to the seller and purchaser. The *Putnam Democrat* reports the sale, by Col. L. McLean, of 60,000 acres, in Putnam county, to D. N. Cumingore, of Covington, Ky., at $6 per acre.

The Great Kanawha Valley is now in a very prosperous condition, its coal operators rejoicing over the large amount of business now being done and the large and constantly increasing demands for its superior gas, splint and block coals,—says our Junior publisher who has just returned from that region, where he met a most kindly reception.

W. Va. Iron Ore.—It is reported, says the Gallipolis Journal, that iron men from Portsmouth have discovered a seam of ore from which Bessemer steel can be manufactured, at or near Glenwood, W. Va. A large number of mineral leases have been granted by land owners at that place to iron men from Ohio.

St. Lawrence Boom and Manufacturing Co.—Upon the invitation of John W. Harris, Esq., one of the directors of the above named company, we made on Tuesday an exceeding-ing interesting visit to their mills located at Ronceverte. The new mill is truly a splendid establishment. The main building is 50 feet high, 134 feet in length and 60 feet wide, with boiler-house and engine room attached, the former 30 x 50 feet, and the latter 14 x 30 feet in size. The engine is of 250 horse power, and six immense boilers supply the steam. The sawing capacity of the mill is 120,000 feet per day.

Under the direction of Col. E. C. Best, general manager, we were shown their process of manufacturing lumber. Commencing at the log-pond, a car attached to jack-works is run down an incline into the water and under the logs, and as the car is drawn up the logs settle down on the iron spikes affixed to the top of the car, which hold them in place until they are quickly hauled up into the mill. Here the logs are rolled upon skids which carry them to the large circular saw, where they are slabed—the logs being turned on the carriage by machinery, in part, and the slabs and slabed log, as they come from the saw, falling upon live rollers which carry them forward, the former to saws which cut them up into pieces of proper length for laths and pickets, and the latter to cross rollers, by which it is transfered to the "gang-saw." The "gang," as it is commonly called, is something like the up-and-down saw of the old-fashioned water mill, except that instead of one saw moving slowly there are 32 saws in the frame, making 215 strokes to the minute, and cuting, not one board at a time, but the whole log, and even two and four logs at a time, the logs being carried to and through the saws by a rotary feed and passing out all cut into boards from 5½ to 26 inches wide, according to the size of the timber. From the "gang" the boards pass on to a car which removes them to the yard for stacking or shiping, or if they require edging they are transfered to the large "edger." This lies forward of and between the gang and the circular saw, from each of which rollers bring the lumber to be edged. Alongside of this is the "edging cuter," a machine filled with a number of small saws, which the sawyer can instantly adjust to any width by levers which are just at his hand, and the timber is carried to these saws by a rotary feed. This machine is a mill within itself, and has a capacity sufficient to edge all the boards and plank manufactured in the mill, besides cuting timbers of small dimensions. Passing the edger the boards are placed on a car and carried on a track, laid with steel rails, to the yard, and the strips as taken off by the edger are pushed upon a sort of table, taken up by endless chains and carried to a number of small saws which automatically cut them into strips for laths and pickets. Just here are the lath and picket machines, the former with a capacity of 60,000 and the latter of 3,000 per day. What will not make plank is passed to the picket machine; what will not make pickets is passed to the lath machine; the residuum, which can't be cut into laths, is sold for firewood; while no other fuel than saw dust is used to run the entire mill. This is carried by box chutes from each saw to a large trough-like arrangement down below, whence it is carried to the engine room and deposited in the furnaces, all by machinery. There is still another very important saw, occupying with its carriage and appurtenances, nearly the whole of one side of the mill, called the "muley." This is a single upright saw, runing 350 strokes to the minute, used principally for cuting. This one will cut in length from 5 to 80 feet, and to it is attached a single edger used for making boards parallel. A short distance above this mill is another, operated by the same company, containing a large circular saw, and shingle, lath, planing, moulding and picket machines.

The business undertaken by this company is the most important enterprise started in this section since the war, and if carried forward successfully will aid greatly in advancing kindred and dependent interests in Greenbrier and Pocahontas counties. Thousands of acres of white pine lands lie along the upper waters of the Greenbrier, while the hard woods of the region are almost untouched. From surroundings such as these Lock Haven and Williamsport, Pa., have grown into large cities. The St. Lawrence Company owns 20,000 acres of these lands. They have a large force employed, backed by ample capital, and they expect to do a lar e business. Their booms extend for a mile and a quarter above Ronceverte, and during the summer they will improve the river and put in another boom, with a capacity of ten million feet, just above Greenbrier bridge. Their lower booms are well filled with logs, a large number have been floated down within easy reach, and they have a crew still cuting on Anthony creek.

The officers of the company are John Driscol, President; E. H. Camp, treasurer; James M. Kinports, secretary, and E. C. Best, general manager. Their master-machinist and operator is Horace Mason, who is also the architect of the new mill. All of these gentlemen are experienced lumber and mill men from the great lumbering regions of Pennsylvania, but have now made Ronceverte their permanent homes. We welcome them to our midst.—*Greenbrier Independent*, May 24th.

The *Forestry Map* of West Virginia, published in the May number of *The Virginias*, shows that the larger portion of West Virginia is still covered with original forests. The only parts of the state that have been cut off are the Valley counties, Jefferson and Berkeley, the northern counties of the Pan-handle and the Monongahela valley, and the country along the Ohio and near the lines of railways; but even in these sections, the portions of the map colored yellow (see map opposite page 80,) as much as 50 per cent of the good timber is yet standing. The yellow belts along the rivers are all too wide; more of Summers and Monroe counties should be colored green, and there should be large green areas in the Monongahela counties. We are informed, by one that had more to do than any other in the preparation of this forestry map, that the words "Region from which the valuable timber has been largely removed" mean, as above stated, those from which about half the valuable timber has been removed.

This map is well worth the careful study of our railway managers, suggesting as it does how by branch lines of existing roads they may penetrate the great forest regions and so become possessed of territory that will contribute largely to their resources, before others occupy it with new lines of transportation.

Since our map was published, the railway from Weston to Buckhannon has been completed and a forward movement made from the Baltimore & Ohio into the unoccupied timber country.

Iron Market Report.—E L. Harper & Co., of Cincinnati, under date of June 25, 1883, write *The Virginias:* The market has been cleared of many off grade outside lots at special prices, and the transactions are reduced in the main to straight trades on regular brands.

Conservative buyers have placed liberal orders and inquiries are very numerous. If the signs of the times indicate anything at all, as to what may be looked for in the early future, prices have about touched bottom, and the market will be active and figures higher before the summer is ended.

They quote *foundry* pig at from $19 50 to $21.50 for coke, and $22.75 to $25.00 for charcoal; *grey forge* $18 to $18.50; *car-wheel* and *malleable* $24 to $29, according to grades and make.

The field study of Geology in the Virginias is becoming quite popular, not only with our Virginia universities and colleges, but also with the colleges and technological schools of other states, greatly to the advantage of their students who have been studying text-books and hearing lectures on geology and mineralogy, and also much to the advantage of these states, since these young men will be educated with a proper understanding and comprehension of their vast mineral and other resources.

The latter part of April the geological students of Washington & Lee University, Lexington, Va., in charge of assistant Professor Harry G. Campbell—who during the greatly regreted illness of his father, Prof. John L. Campbell, has ably and worthily filled the place of professor of chemistry and geology in that institution—and those of Roanoke College, Salem, Va , in charge of Dr. W. H. Ruffner—who has been delivering a course of popular lectures on geological subjects, with especial reference to Virginia geology, at that college—and Prof. L. C. Wells, united in a geological excursion of three days, mainly on the line of the Richmond & Alleghany RR., where some of the finest geological sections in the Union are perfectly exposed and very accessible. The points of special interest were : the grand exposure of Archaean and Lower Cambrian rocks at Balcony falls (the passage of James river through the Blue Ridge), and the remarkable Silurian sections of Eagle Rockand Clifton Forge; Low Moor furnace and its great ore and limestone beds on Ches. & Ohio Ry., were also visited.

During May I. C. White, Professor of geology and natural history in West Virginia University, took ten of his students for a month's field work, taking a boat at Wheeling, W. Va., and going down the Ohio to the mouth of the Great Kanawha, measuring sections along the Ohio—some of which he has kindly furnished for this number of *The Virginias*—then up the Great Kanawha and New rivers, measuring No. XII sections on the Ches. & Ohio Ry. on New river. Crossing the Alleghany by the Ches. & Ohio this party studied the grand section, III to VIII, at Clifton Forge, then went by Richmond & Alleghany RR. to Richmond, studying the fine Mesozoic and Tertiary beds there exposed; thence to Old Point Comfort by the C. & O., thus passing in review all the geological formations of the Virginias, which are the equivalent of the whole American geological column. From Old Point the return to W. Va. University was by way of Ches. & Ohio to Waynesboro, the Shenandoah Valley to Shenandoah junction (stoping to visit the Luray Caverns), by Baltimore & Ohio to Fairmont, and thence by stage to Morgantown—a geological excursion that under such a wise teacher as Prof. White will be of lasting benefit to the bright, well-trained and observing students that participated in it.

During this month two parties of northern students have been studying the rocks and ores of the Virginias; one from Dartmouth College, New Hampshire, in general charge of Prof. C. H. Hitchcock, that examined the country along the lines of the Shenandoah Valley and Norfolk & Western reilways; and one of some seventeen students from the Massachusetts Institute of Technology, Boston, in charge of Professors Richards and Ordway and Mrs. Richards, that made observations along the lines of the Shenandoah Valley, Norfolk & Western, Richmond & Alleghany, and Chesapeake & Ohio railways. The Editor of *The Virginias* had the pleasure of meeting the last named party at Clifton Forge and giving it a lecture on Virginia geology in the grand gorge of Jackson river at that point.

Prof. Fontaine has been exercising his students on the Mesozoic areas of Virginia along the tidal James, gathering new material, we presume, for the fine monograph on the fossils of that age found in Virginia, now in course of publication by the U. S. Geological Survey.

Our railways deserve commendation for their liberal policy towards these students of geology, generally conveying them free, or charging but nominal rates. They will be amply repaid by the publicity that will be given to the extent and character of the mineral resources along their lines by these the future mining engineers and geologists of the country.

Shipment of Kanawha, No. XIII, Coals.—A correspondent of the "Daily Evening Journal" of May 18, 1883, writes : I have procured from Capt. A. M. Scott, the engineer in charge of the government improvement on the Great Kanawha river, a table showing the number of bushels of coal mined and shiped from mines bordering on the Great Kanawha river from Cannelton down. It is proper to state : (1) that this estimate does not include any of the operators in the New River valley; and (2) that the shipments for 1883 will greatly exceed those of 1882.—Those marked with a star are estimated :

Operators.	By rail.	By river.
Coal Valley Coal Co.	948,192	.....
Stuart M. Buck	490,308	399,184
Bennington Colliery		530,684
Geo. Straughan	918,316	90,356
Carver Brothers	703,188	266,100
Mt. Morris Coal Co.	481,320	23,800
Cannelton Coal Co.	310,000	.....
Eureka Coal Co.	271,198	.....
Campbell Creek		2,409,260
Peabody Coal Co.		311,024
Kanawha Min'g and Trans. Co	274,604	39,312
Robinson Coal Co.	1,643,824	70,112
Dana Brothers		760,144
Raymond City Coal Co*		2,409,260
Pioneer Coal Co*		2,409,260
Totals	6,631,660	9,628,696
Totals by river and rail	16,260,356.	

West Virginia's Twentieth Birthday.—On the 20th day of June, 1863, and twenty years ago to-day, the new state of West Virginia was born into the Union of States, and the ceremonies attending that event were concluded in this city by the inauguration of Hon. A. I Boreman, of Wood county, its first governor, and the organization of its first legislature.

It was the culmination of an ambition which had been lurking in the population of West Virginia for thirty years or more, but it was reserved for a great national calamity to open an opportunity which our people seized upon with a keener sense of expediency than of scrupulous constitutional proprieties.

The first act in the series of events that led to the formation of a new state, may be said to have been that of the Richmond convention in April, 1861, which adopted the ordinance declaring Virginia seceded from the Union. Our section of the state was fully represented in that convention, but a majority of her members voted against it, and returned home to denounce the action with such vigor as to fan the anti-secession sentiment into a fierce revolutionary flame.

In response to this sentiment representitives from twenty-five western counties met at Wheeling on the 13th day of May, 1861, less than one month after the passage of the ordinance of secession, and adopted resolutions denouncing the ordinance of secession, and providing for a convention of all the counties of Virginia adhering to the Federal government.

This convention, representing forty counties of the old state, assembled at Wheeling on the 11th of June, 1861.

They proceeded to repudiate the action of the Richmond convention, and to reorganize the government of the old state under the title of the "Reorganized Government of Virginia," with Hon. F. H. Pierpoint as its executive head.

This body then called a new state constitutional convention which inaugurated its labors in this city on the 26th of Nov., 1861. A new constitution was framed, the consent of the legislature of "Reorganized Virginia" to the formation of the new state was given on the 13th of May, 1862, Congress passed an act admiting West Virginia into the Union as a state, President Lincoln approved it on the 31st of Dec., 1862, a general election for the new state government was held on the 28th of May, and on the 20th of June, 1863, forty-eight counties of the territory west of the Blue Ridge became an independent state. Subsequently the counties of Berkeley and Jefferson were added, and since there have been four new counties formed out of parts of the original number.

This is an outline of the events which have given an existence to an independent state and which will be reviewed with interest to-day by many of our people who were the moving spirits in those exciting times and who still remain on the field of action battling with the industrial problems that have superseded the political conflicts of the earlier days of our young state.

Two score years have been marked by a steady and gratifying progress in the growth and development of our little republic that flatters the pride of our people and opens a future of ambitious speculations. When West Virginia was admited as a state her total population as shown in the counties now included, numbered 376,688. The increase in these counties in the decade from 1850 to 1860 was about 25 per cent. Since that time she has nearly doubled her population; the last census showing a population of 616,413, and an increase during the decade between 1870 and 1880 of nearly 40 per cent.

We might enumerate at great length the many other evidences of her industrial growth and prosperity; we might dilate upon the infinite resources which nature has deposited in her lap; we might tell of her great oaks and her iron, her ores and her coal, the immense wealth of timber growing upon her surface, which is being manufactured by a perpetual water power that leaps from the crags of her mountains down into her gentle valleys; but all the world begins to know and appreciate these things.

Such a state as West Virginia, so full of the varied treasures of the forest and mine, within a few hours of the sea, with its natural and acquired facilities for transit always developing and improving, with its green pastures flowing with milk, and its hills and mountains that promise to run with wine, will never lack inhabitants or the hum of industry, and each succeeding decade will furnish even greater evidence of our possibllities as a great state than we have even on this twentieth birth day.—*Wheeling Register.*

The Geological Formations of the Virginias.

By Prof. Wm. B. Rogers.

(Continued from page 72)

Formation No. XIII—the 14 b. Lower Coal Group of the Upper Carboniferous, the Seral of the 1st Pa. Geol. Survey, the one that should properly be called the Middle Coal Measures of the Basin of the Ohio, is described as follows in the 1839 Va. Geol. report.

"Under this head it is deemed convenient for the present to include the whole of that diversified series of rocks comprising sandstones, fine, coarse, and conglomeritic, slates, shales, limestones, and seams of coal, which occupy nearly the whole of the wide area lying beyond or west of the formation just described.

In remarking upon this formation no attempt will be made to give a minute account of the more important groups of strata which it comprises, as such a description, even though it were partial, would involve an amount of details incompatible with the design of the annual reports, and as moreover much further examination is requisite in nearly all portions of our great coal region to enable me to present its economical and geological characteristics in the ample form necessary to render a description of them satisfactory and useful. I shall therefore confine my observations under this head to a general account of the formation as presented at different and remote parts of the region, with a view of illustrating some of the more important modifications by which it is affected in extending from tract to tract, as well as of indicating certain important landmarks among the very numerous and variable strata of which it is composed, adapted to furnish us with valuable aid in assigning their true limits to the chief subdivisions of the formation, as well as in conducting our explorations for practical purposes on sure principles and to useful results.

Throughout the larger part of the entire thickness of this formation, commencing at its lower surface, or where it rests upon No. XII, the rocks are chiefly of a decidedly siliceous character, consisting of sandstones of various textures, from the finest grit to coarse conglomerates, generally containing some, and often a large amount of mica, presenting considerable variety of hue, comprehending blended tints of grey, light brown, and greyish green, and in some cases almost pure white. Associated with these are layers of limestone for the most part of a dull bluish grey, but sometimes of a dark brown and nearly black tint, and generally shewing an ochreous aspect on the weathered surfaces. These beds, as met with in Virginia, are rarely more than a few feet in thickness, varying in this respect from point to point, and not unfrequently losing themselves by gradual transition into slate or iron ore, or sandstone. Numerous beds of slate also interpose themselves between the siliceous rocks, presenting for the most part a dark brown or nearly black, and an ochreous greenish colour. It is with these, particularly the former, that the coal seams are in general immediately associated. The bands of iron ore also usually occur in or adjoining them, as well as contiguous to the layers of limestone.

Towards its upper limits rocks of a less arenaceous character predominate. The sandstones which still occur in heavy beds are of a softer and in general finer composition, and the slates assume the form of argillaceous shales of a crumbling texture and deep reddish colour, alternating occasionally with green and ochreous tints, presenting a striking general resemblance to the shales of IX. and XI. of the Appalachian series. In this part of the formation the calcareous beds in general occupy a far greater thickness than below, imparting a richly productive character to the region over which in some portions of the great coal tract they are widely spread out. Calcareous matter is also present in considerable amount in the associated shaly strata, which are therefore in general marked by a productive soil.

Near the highest strata of the formation little or no coal is met with, but among the beds next beneath occurs one and in some cases two coal seams of great value, as well on account of the usually good quality as the abundance and continuity of the coal. It is in this geological position that we meet with the celebrated Pittsburg coal in Pennsylvania, and, as hereafter will be shown, the valuable seam explored in the hills at Wheeling, Morgantown, Clarksburg, and numerous intervening points The two principal seams in the Potomac basin, to be noticed in the sequel, are evidently referible to the same position.

Besides the general differences noticed in the nature and aspect of the materials predominating respectively towards the lower and upper portions of the formation, important modifications in the composition and degree of development of its several subdivisions are seen to occur as we trace them from one portion of the great basin to the other, some of which, from their economical importance, as well as their general occurrence, merit a brief notice in the present sketch of the formation.

One of these changes is exhibited in the increased coarseness of the materials forming the arenaceous strata of the lower parts of the formation as traced from the northern limits of the state to the valley of the Great Kanawha, and at the same time the greater preponderance of the sandstone strata occasioned by their increasing thickness in that direction. This fact is well exemplified in comparing the rocks lying between the western base of Laurel Hill in Monongalia county, and their counterparts along the Kanawha, from the falls as far down as Charleston. The comparatively small amount of slaty strata along the latter section, though fortunately unaccompanied by any diminution in the thickness or deterioration in the quality of the coal seams there so admirably exposed for long distances continuously in the river hills, would appear to connect itself with the attenuated width of the bands of iron ore occurring among these slates, and therefore would seem to give a general confirmation to the conclusion derived from our observations thus far, that these ores are much less abundant in that than in some of the more northern divisions of the coal field.

In the calcareous strata, especially those appertaining to the higher subdivisions of the formation, an equally marked alteration is exhibited. As followed in a southwesterly direction from the Pennsylvania line, these beds spreading widely over the tracts lying to the west of the Monongahela, are seen gradually becoming thinner by the interposition of strata of variegated calcareous shales, until over the western parts of Harrison Lewis and Kanawha, as well as nearly all of Wood, Mason, Jackson and Cabell counties, a small and variable remnant of these rocks is met with, forming thin bands among these shales, which have now almost entirely usurped their place. As a striking illustration of the remarkable change here noticed, reference may be made to the expanded thickness of the limestone strata in the hills bordering the Ohio, in the vicinity of Wheeling, where these rocks appear to have attained their greatest development as compared with the thin and variable seams of calcareous rock encountered in the region between Charleston and Parkersburg on the one hand, and Guyandotte on the other. Of the real extent and frequency of these small bands, further observations are requisite to enable me to speak with confidence; the region in which they are met with, having as yet, been but partially explored. They will, however, receive that attention which, from their local importance in connection with ordinary and agricultural uses, they are believed to claim.

From what has now been said in the way of a general sketch of the prevailing characters exhibited in the lower and upper portions of this formation, as well as the interesting modifications occurring in each as developed in distant portions of the coal region, it must be apparent that the whole formation admits of being conveniently divided into two great groups of strata, each comprising sandstones, slates, shales, limestones and seams of coal, but yet sufficiently distinguished from each other by the predominating features above described. Adopting such a division therefore as conducing to a greater clearness and simplicity in the economical as well as geological illustrations hereafter to be given, I shall for the present designate them respectively by the titles of *the lower coal series* and *the upper coal series.*

It cannot fail to be remarked, that in the perplexing and laborious investigations which are so often undertaken with the view of discovering or tracing the coal seams or other strata of the region under consideration, great assistance would be derived from the knowledge of some one bed or stratum, whose continuity over wide areas and constancy in in position in regard to other rocks, had been satisfactorily demonstrated. For in a region so broken, as is much of that of which I speak, and in which the strata present frequent though gentle undulations of dip, and often bear a strong resemblance to each other, the attempt at tracing them by an imperfect system of leveling, aided by rude computations of the angle of dip, is likely in many cases to lead to results not only erroneous, but prejudicial to individuals and the public.

It is on this account therefore that in the course of our operations in this region, as thus far carried forward, I have made it a leading object in the first place to acquire the necessary data for drawing, with some degree of accuracy, whenever possible, the line of separation between the lower and upper coal series, as well as for tracing the more valuable coal seams or other useful deposits, by reference to some *standard bed or stratum*, whose persistency over wide areas has first been satisfactorily established.

Our observations thus far in regard to the rocks towards the middle of the formation, would seem to shew, that between the upper and lower series. there is generally interposed a greater thickness of strata, barren of workable seams of coal, than either above or below, but of the constancy of this fact it is impossible to speak until I have completed a number of measurement proposed to be made at various points in the coal region, nor would a feature of this kind, unless exceedingly distinct, be of much avail to those who are interested in explorations for coal Some mark more definite in its nature should, if possible, be determined. Such a one, I am happy to say, has been found to exist in that portion of the coal field which is traversed by the Kanawha river, and though not discovered until some time after the commencement of our operations during the last season, it has already enabled us to obtain a clear knowledge of all the general, and most of the minute features of that highly interesting and valuable part of the basin.

The land-mark to which I here allude, and which was first recognized, and afterwards diligently traced by my brother, Prof J. B. Rogers, consists of a band of black or bluish black siliceous rock, approaching the character of a flint or hornstone, which is found in the hills at the height of several hundred feet above the river near the falls, and which, accompanying the subjacent strata in their various undulations, and their ultimate steady western dip as they extend down the river, is seen to disappear below the water level at the Elk river shoals.

This stratum, from its striking peculiarity of character, and its constancy of geological position, furnishes a standard line with which to compare the rocks and coal seams both above and beneath, and may be regarded in this region as clearly defining the boundary between the upper and lower series. As will be seen hereafter, throughout the tract extending from the falls to the point at which the flint comes down to the river level, no seams of coal, but such as are local and of insignificant extent, occur in the hills above this stratum, but as we proceed towards the west, and thus in virtue of the westerly dip of the rock, pass successively into strata, higher in the geological order, we meet with one or more coal seams associated with the shaly rocks already noticed as predominating in the upper series."

This flint ledge was afterwards adopted by Prof. Rogers as the dividing stratum between formations No. XIII and XIV.—*Editor.*

A request for Words.—The Century Co. proposes to publish a new English Dictionary, based on Ogilvie's Imperial Dictionary of the English Language and edited by Prof. Wm. D. Whitney of Yale College; in a notice of this great work we find the following request:

"Feeling, however, that a work with such aims and conducted under such leadership must awaken the active interest of all who desire to promote a better knowledge and use of the English language, we take the liberty of requesting students of English and those familiar with the vocabularies of the different sciences and trades to send us any special criticism, any rare or new word or new use of any old word, any peculiar phrase or local idiom, any rare citation or any especially appropriate citation illustrating a familiar word, which may have attracted their attention, and which they may be willing to permit the editor of the dictionary to use. We especially request that, when practicable, the words may be accompanied by some quotation and the name and page of the book in which it is found. Any suggestions which may be made to us will receive careful attention; and manuscript matter will, if desired, be returned to the sender after being used. Communications should be addressed to the Editor of the Century Dictionary, in care of The Century Co., Union Square, New York."

We hope our Virginia and other Southern readers will avail themselves of this opportunity to have placed in a great word-book the numerous words of excelent repute and use among us that do not appear in either of the American dictionaries hitherto recognized as standards. Two illustrations of the short-comings of these dictionaries have come under our attention in a few days; the proof reader of the extensive publishing house of D. Appleton & Co., New York, insisted that the word "Knobly," the euphonious and only known name of a great Virginian mountain range, should be changed to "Knobby" in the Virginia papers of Prof Rogers, now passing through the press, because no such word appears in Webster or Worcester; in a geological exploration in Virginia with Prof. N. S. Shaler, the quick-wited and distinguished Harvard professor of geology, we were surprised to find that he did not know of the use of the word "draft" as descriptive of the gathering ground of a stream, one so very common in Virginia,—but we subsequently found that the word in this sense had no place in Webster or Worcester.

Monongalia county, W. Va., a parent county of Virginia, one organized at Williamsburg, Va., from West Augusta, in 1776, is to be illustrated by a history of from 650 to 800 octavo pages, brought out by the Preston Publishing Co., Kingwood, W. Va. The book will be sold only by subscription.—We are pleased at the interest now taken in the subject of local history in the Virginias, and would urge all our people to aid such laudable undertakings.

The right way to secure.—The Baltimore and Ohio express messengers, agents and others who handle money have been notified that after June 1st no personal bond will be accepted, and that such employes shall give a bond signed by the guarantee company, and that ½ of 1 per cent will be allowed on such employe for said bond. An agent will thus have to pay on his $5,000 bond $37.50 annually, and a messsenger on a $3,000 bond, $22.50.—*Keystone Courier.*

Cumberland Gap.—We are indebted to Chief Geographer Henry Gannett of the U. S. Geological Survey for the following determination of the position of the Pinnacle at Cumberland Gap, Va. and Ky., to the nearest tenth of a minute,—latitude 36° 36'. 4 north; longitude 83° 39.'6 west.

Walker as a Geographical term is quite common in Southwest Virginia. The first and second of the great parallel Apalachian ranges that bound the Valley on the west are generally known as the Little and Big North mountains from the Potomac southward to the vicinity of New river, but from that river southward to near the Tennessee line, where these ranges die out, they are known as Little and Big Walker mountains. There are also Walker creeks; notably Big and Little Walker creeks that drain a large area to the westward of the mountains of the same name, in Bland and Giles counties, and that, as Big Walker creek, empty into New River above Ripplemead station of New River branch of Norfolk & Western RR.

It is probable that these names were derived from Dr. Thomas Walker, of Castle Hill, Albemarle county, Va., a man of note in the last century. (the maternal grandfather of Hon. Wm. C Rives, etc) who was one of the first explorers of Southwest Virginia. His great-grandson, Mr. Wm C. Rives, has a portion of a journal kept by Dr. Walker during one of these explorations from March 16th to July 12th, 1750. From this we learn that his course was up Roanoke river (which he called Staunton), probably to the vicinity of the present town of Roanoke; then to New river, Peak and Reedy creeks, across to and down forks of Holston river, across the mountains to Clinch river and then across the Great Carboniferous escarpment, here called Cumberland mountain, noticing the outcrops of "coal," to Cumberland river, in Kentucky. He then returned to Powell River valley and skirted along the Carboniferous escarpment, noticing "a plenty of coal" and "white clay under it," apparently to Guest river, then up that river and across to a river he named "Louisa." It seems that he crossed from the Louisa to the Tug fork of the Big Sandy, up which he went, with great difficulty, to its head, near the present mining village of Pocahontas; noting that the ridge at its head "is nigh the eastern edge of the coal land,"—showing that he had comprehended the geological structure of that part of the Great Coal Basin of the Ohio

His way from near Pocahontas appears to have been down Bluestone river and along Great Flat-top mountain to New river at the mouth of the Greenbrier; then up the Greenbrier to Anthony creek, across Alleghany mountain to Jackson river, then by way of the Hot Springs, Panther gap (on Ches. & Ohio Ry.), Staunton and Charlottesville to his home at Castle Hill, near what is now Cobham station of Ches. & Ohio Ry.

He mentions traveling at times in "much frequented Indian roads" and in "plain buffalo roads," for both these animals were then plentiful in this region.

The diary from which we gather this information is full of interesting items, and we hope its owner, Mr. Wm. C. Rives, will publish it, now that much interest in the early history of Virginia is being manifested.—Dr. Walker and his party were probably the first white men to go over the hundreds of miles of unbroken wilderness embraced in this journeys.

The Old Dominion Steamships, Guyandot and Roanoke, that run between Norfolk and Old Point Comfort, Va., and New York, as we learn from the "Norfolk Virginian," have made their passages between Norfolk and New York during the past year in an average of 22 hours, having been behind schedule time but once during the year, a time record equal to that of any railway.—These fine steamships are an extension to New York of the lines of the Chesapeake and Ohio and Norfolk & Western railways; they furnish a delightful way for travel and a cheap and speedy transit for freight, and what a delightful break for the traveler to stop for a day at the Hotel Warwick at Newport News, the Hygeia at Old Point Comfort, or the Atlantic at Norfolk!

The cost of Pig-Iron Making in the South.—The following article from the editorial columns of the Baltimore "Journal of Commerce," of June 16, is well worth the attention of all those interested in the production of pig iron. We have recently had occasion to re-examine the question of the manufacture of charcoal pig in the Valley and Apalachian counties of Virginia, near the lines of the great railways traversing those counties, and are satisfied that under existing conditions such iron can be made there as cheaply as this article says it can be made in Georgia.

"Within the last few years there has been a very marked development of the pig iron interests of the Southern states, many new furnaces having been erected in that section despite the unsatisfactory condition of the trade in Pennsylvania and elsewhere. It has been generally admited that this was due to the ability of Southern furnaces to make pig iron at a lower cost than could be done in other parts of the country, and with a view of gaining some definite information upon this point the 'Baltimore Manufacturers' Record lately invited from Southern furnace proprietors a general discussion of the subject, and in its last issue published a number of letters, from which we extract the following points: Messrs. Hileman, Waring & Co., proprietors of the Callie furnace in Virginia, in giving the average cost for making a ton of pig iron at their furnace, put down 3,432 pounds coke at $6.89; 6.049 pounds ore at $1 62; 3,839 pounds limestone at $1.03; labor $2.54; and incidentals $1, or a total of $13.08, which these gentlemen state to be rather over than under the actual cost. Mr John C. Kaisters, M. E., superintendent of the Powell's Fort Mining Co., Shenandoah county, Va., figures out the cost at his furnace at $13.-56, but says by enlarging stack he can reduce this to $12.62, allowing $5 per day for interest on tools, &c. Mr. Kaisters states that in 1880 he sold iron in Baltimore at $47 per ton —quite a liberal profit. Writing from Cartersville, Ga., Mr. J. D. Thomas, one of the owners of the Bear Mountain furnace, says that even under their past workings, which have not been economically managed, the average cost of pig iron has been $10.20 per ton.

One of the most interesting letters, and the one that gives the fullest details of the cost, is from a furnace proprietor in Polk county, Ga., who makes only the best quality of strictly cold-blast charcoal iron for car-wheel purposes, and he puts the cost down for this kind of iron at $16.50 per ton, stating that he had made it for less, and that the cost has never been over these figures. Mr. J. E. Johnson, the superintendent of the Longdale Iron Company, whose furnace is one of the largest in Virginia, writes: 'I have no hesitation in saying that I believe the statements recently published, placing the cost of iron-making at a number of localities in Virginia at from $11 to $13, are true *now*;' but he thinks that this cannot last, and that as the most easily-mined ores are exhausted the cost will increase. If iron can be made in the South as cheaply as these gentlemen claim and it is to their interest to overestimate rather than to underestimate the cost, it will soon become a serious question as to how many Northern furnaces, which claim to be unable to produce it at less cost than from $16 to $17 a ton, can stand the increasing competition from the South."

The Duty on Coal.—"After July 1, 1883, a drawback of 75 cents per ton shall be allowed on all bituminous coal imported into the United States, which is afterwards used for fuel on board of steamers which are engaged in the coasting trade of the United States, or in the trade with foreign countries," says one clause of the evil and hard-times-making tariff act imposed on the country by the connivance of both the political parties at the last session of Congress.

Coal and Coke Traffic of Ches & Ohio Ry., May, 1883.

General Manager C. W. Smith sends *The Virginias* the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during May, 1883, and May, 1882, in tons of 2000 lbs., compiled by fuel agent C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	1,741	3,465	.....	1,724
Gas	35,867	32,663	3,204	.....
Splint and block	8,229	8,773	....	544
New River, &c	37,684	30,860	6,824	.....
Coke	7,763	5,204	2,559	.....
Totals	91,284	80,965	12,587	2,268

Comparing the above with the report for April, on page 69, it appears that there was a falling off of 4,085 tons in May as compared with April.

The net increase in May, 1883 over May, 1882, was 10,319 tons, or over 11 per cent.

The distribution of the above was as follows:

	1883.	1882.
1. To C. & O. Co. for its own use	17,044	15,904
2. To Huntington, for West via Ohio river	3,354	8,426
3 On Elizabethtown, Lexington & Big Sandy RR	1,139	3,507
4. On Ches. & Ohio Ry., excepting Richmond.	12,834	14,346
5 To Richmond & Alleghany RR. at Clifton Forge.	786	1,954
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	12
7. To Shenandoah Valley RR. at Waynesboro	20	472
8. To Va. Midland Ry. { At Charlottesville	2,566	94
8. To Va. Midland Ry. { At Gordonsville	.....	21
9. To Richmond, Fredericksb'g & Potomac RR Junc	1,240	581
10. To Richmond for consumption, including tugs, &c	12,697	10,174
11. To James River wharves for shipment	12,754	22,730
12 To Newport News { Consump'n includ'g tugs &c,	733	.....
12 To Newport News { For shipment	26,117	2,744
Totals	91,284	80,965

The striking feature of the above distribution is the very large increase in shipments eastward, to Richmond and Newport News the deliveries to the latter point in May showing an increase of 26 per cent over those of April.

The following table presents the progressive traffic from January 1 to May 31, inclusive, for 1883 and 1882.

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	10,543	11,242	.....	699
Gas	155,370	125,179	30,191	.....
Splint and block	45,715	60,754	.....	15,039
New River, &c	180,972	142,074	38,898	.....
Coke	48,373	39,277	9,096	.....
Totals	440,973	378,526	78,185	15,738

The net gain of 1883 over 1882 to June 1, appears from the above to have been 62,447 tons, or nearly 18 per cent.

Potomac, Fredericksburg & Piedmont RR. Tonnage in 1882.—Supt. Wm. M. Grafton sends us the following statement of part of the tonnage carried over P., F. & P. railway during the calendar year 1882, in 2000 lbs. tons;

Lumber	24,512	Fertilizers	778
Flour	198	Wheat	1,815
Cord wood	6,929		
		Total	34,232

The westward tonnage was 6,333 tons; the eastward 34,-894,—total 41,227.

This narrow-gauge railway extends from Orange, on Va. Midland, to Fredericksburg. A passenger train runs daily at 8:55 a. m. from Fredericksburg, reaching Orange at 11:40 a. m.; and from Orange at 1:30 p. m., reaching Fredericksburg at 4:30 p. m.

Notes on the Mineral Deposits at certain Localities on the Western Part of the Blue Ridge.

By Wm. M. Fontaine, Professor of Geology in the University of Virginia.

(Concluded from page 76.)

The strike could not be made out so positively, but appears to be 40° E. of N. A friable sandstone of light buff color, forms a band in the quartzite. It is the same band that furnishes the sand of the alluvial deposits, and the boulders near the saw mill in the vicinity of Greenville. Passing over the Chimney rock to the summit of the mountain, the top is found to be comparatively level, and to have occasional outcrops of shattered quartzite cemented by iron ore. At some of these outcrops the ore is free from rock, and is solid and massive. No opening is made of sufficient size to expose the amount and occurence of this ore. It has the dark color and glassy look usually found in the limonites lying in, or close under the quartzite. This ore shows on analysis 54.6 per cent of metalic iron, 35 per cent of silica, and 1 per cent of phosphorus. At the N. E. end of this mountain, and on its S. E. slopes just under the Potsdam quartzite, is a layer of flags or sandstone highly impregnated with limonite, much resembling in its mode of occurence the ore of Craig ridge. This bed has been traced for several miles and is apparently persistent. It will probably prove to be an important source of iron. At the point inspected by me the ore is for the most part rather lean and silicious, although some good massive material can be selected. It is mostly a yellowish brown limonite, but a little of it is dark brown. It is the constant presence of iron in this bed over so great an extent of ground, that renders it important, as the chances are that at several points, the ore may become more free from siliceous matter. The ores of the shales west of this mountain now claim our attention.

The principal openings for ore in the shales, have been made on the most westerly of the deposits, or those nearest to the river. These occur with a concretionary structure, and often nodular character, imbeded in clay. The form in which the ore occurs is usually as irregular beds, or rather masses, composed of sheets or nodules of ore, mingled with more or less clay. These masses assume roughly the character of bands of clay containing here and there deposits of ore. In other words, if we run parallel bands in a N. E. and S. W. direction, we will find the ore-bodies grouping themselves *en echelon* in these bands. The most westerly deposit seen by me had not been worked, but had been opened by a small pit, now filled in. It is a highly manganiferous ore nearly black in color, and showing on analysis, metalic iron 27 per cent, metalic manganese 20 per cent, phosphorus .84 per cent. Lumps of nearly pure manganese might be selected. A little to the N. E. of this, and west of the present workings, is an open cut not now used. This is made on a ledge of argilaceous ore that shows the same features as the ledges now standing at Mt. Torrey and Bare banks. The best ore has been taken out. This ledge is mingled with a good deal of clay. It stands near Big Chalk run to the N. E. of the engine-pit. Masses of ore may be seen sticking out of the bank of Big Chalk run near by, that are probably transported from their original position. About 100 yards to the S. E. of this we find the engine-pit now operated, and from which a large amount of good nodular ore has been taken. It was worked by an open cut at first, but now has a shaft, and is worked below the surface. This pit, with the underground working has been carried to the depth of 65′ in ore. The ore occurs mainly in sheets or ledges that dip flatly to the S. E. This is a common mode of occurence for these shale ores. The material on the west of the ore deposit consists of pebbles of Potsdam shale, &c, with kidney ore connected together by ferruginous matter. Next, to the east, we have a mass composed of ledges of nodular ore 20′ thick, then a clay seam 18″ thick. Next to this comes a mass of ore in sheets or ledges, and then on the east wall, ledges of ore imbeding some fragments of shale. The whole mass of workable ore is about 90′ thick. The above details of the structure and character of the Engine-pit ore, I owe to Capt. Jordan, the manager of the works and part owner of the ore beds. He states that the shaly matter imbeded in the ore on the walls goes down as far as the ore has been followed. He also states that the balls or nodules of ore often contain water in their interior, and are sometimes mere shells. These facts show conclusively that the ore results from the concentration by concretionary action, of the iron once diffused in the shales. A little distance off to the S. E. lie the old workings now abandoned. In these, from what I could learn, the mode of occurence is somewhat similar to that found in the Engine-pit, but with a much larger proportion of nodular and kidney ore. This deposit was worked in Colonial times, and for a long time afterwards, up to a recent date.

According to the statement of Capt. Jordan the ore was followed first by an open cut, and then by a shaft to the depth of 170′, and an immense amount was obtained. It was mostly in a nodular and loose condition, and would run under the stroke of the pick. This great depth shows that the shales have in certain places been decayed very deeply, and given rise to very extensive masses of ore. This deposit was abandoned, not because the ore gave out, but because the expense attending the removal of the water rendered it cheaper to get ore from other points nearer the surface. About ½ of a mile east of the Engine-pit we find outcrops of ore runing N. E. and S. W. in a pretty well defined band, but which appear rather as a succession of ledges than a continuous single one. This ore is different from that occuring in the more westerly deposits. It is imbeded in alluvial clay, and and is nodular in form. The ore now in question is surrounded, it is true, with clay, but this seems to be found in place, as is the case with most of the Ferriferous shale deposits. It has been opened only by shallow surface pits, and hence I can give only the appearance of the surface ore. It crops out in boulder-like ledges and masses, and is a compact massive ore, generally free from earthy impurities, and quite different in physical character from the nodular ore farther west. The outcrops may be traced over a belt more than a mile in length. The trend of the outcrops is N. E, and S. W. At the S. W. termination of the outcrops it has approached to about 300 yards from the Potsdam quartzite. The slight ridge that contains the ore breaks down at this point and it disappears to the S. W. A very large amount of ore may be obtained from these deposits. At the S. W. termination of the outcrops, cross-cuts made on the ore, show a width of at least 40′-50′, with an unknown depth. The ore is quite solid here. The ores now worked at Buena Vista have been thoroughly tested. They make an iron used for car-wheels. The manganiferous ore, whose analysis was given above, is clearly a different material from the other ores.

Below Buena Vista I had no opportunity to examine the iron deposits. The owners did not live in the vicinity, and as a consequence, I could find no one to provide for the proper exhibition of them. I could not procure horses, and as the distance was too great for walking, the attempt to visit the ore was abandoned. Iron ore is found on the Brady property that comes next to the Buena Vista property, and on the Echols property that extends to near the junction of the North and James rivers, at the west end of the Balcony Falls pass. They occur in the Ferriferous shales, and close to the Potsdam quartzite. This latter may be seen forming

the most westerly ridge of the Blue Ridge, and diping steeply to the N. W. Several openings are visible in the distance on the Echols property. They have not been worked for a long time. Ore was obtained from them by the Powhatan iron company. I was informed that in one of the openings a beautiful white sand was found in large quantity. This is now buried under the earth washed into the excavations. I I could learn little that is definite about the amount and character of the ore on the Brady property. A large deposit of impure psilomelane, or rather manganiferous iron is said to exist on this property. From its description it has too much iron to be used as an ore of manganese. It is said to have a considerable amount of phosphorus. This, if true, would prevent its utilization for spiegel-eisen.

Arnold's valley lies to the S. W. of the junction of the rivers at Balcony Falls. It contains important ores. For a long distance to the S. W., along the west face of the Blue Ridge, the same conditions prevail as to the N. E. in the region described. Hence we may expect to find in this section similar ores under and over the Potsdam quartzite.

Balcony Falls Cement.—This cement is manufactured at Balcony Falls by the Messrs. Locher, from a ledge 13' thick occuring in the limestones of the base of the Caloiferous formation. The decayed outcrop of this ledge forms a lemon-yellow ochre of very uniform character and fine grain. It has been tried for paint, and found to answer well, according to Mr. Locher Sr. The cement has a high reputation. It sets quickly, some of it in 3 minutes, and produces a fine building material. Its binding power was shown, according to Mr. Locher, in the great freshet of 1870. This tore out the wing wall of the dam of the cement mill, the stones of which were cemented by this material. According to Mr. Locher, the wall went over in one mass. It is also stated by him that cement put down during the building of the James River and Kanawha canal, 20 years ago, has been found to be as hard and sound as when first used. The analysis of the stone used for the manufacture of the cement, was made by Col. Gilham, of the V. M. I., with the following results:

	Raw.	Burnt.
Carbonic acid	30.4	. . .
Potash	.120	. . .
Silica	34.225	49.530
Alumina & trace iron oxide	7.8	11.288
Lime	17.380	25.152
Magnesia	9.513	13.769
Water and organic matter	5.00	.
Loss	.62	.261

To judge from the looks of the decomposed outcrop of the cement rock, there must be more than a "trace" of iron in it.

An analysis of the Balcony Falls cement stone was made by Mr. C. L. Allen, in the laboratory of the University of Virginia, with the following results:

$Ca\ Co_3$	44.55
$Mg\ Co_3$	34.83
Silica	17.21
$Fe\ Co_3$	1.62
H_2O	1.15
Al_2O_3 and K_2O	traces.
Organic matter by difference	.64

Only .47 of the silica was amorphous.

W. Va. Central and Pittsburg RR.—At a recent meeting of the able directory of this company, at its office, 57 Second St., Baltimore, Hon. H. G. Davis, president of this railway, reported that the work on the line to the summit, near Fairfax Stone, was being vigorously pushed, and would probably be completed early this fall. The president was then authorized, if he thought it advisable, to extend the road from Fairfax Summit to the junction of the Beaver and Blackwater rivers, and to have surveys made looking to an early connection with the Chesapeake & Ohio Railway.

A reference to the excelent geological map of the Upper Potomac Coal basin and its market connections that appeared in *The Virginias* in May 1882, will show that the extension above mentioned is to the southern border of the Upper Potomac coal basin on the waters of Cheat river, Tucker county, W. Va., where easy access can be had to all the coal beds of that basin.

We are pleased to note that surveys are authorized looking to an ultimate connection of this road with the Chesapeake & Ohio. Once across the Potomac-Cheat summit, the way is comparatively easy for an extension up the Dry fork of Cheat and its Gandy fork, through a finely timbered and rich limestone country, to the interlocking of that fork with the waters of the Greenbrier, and then down the valley of that river to the Chesapeake & Ohio near the White Sulphur Springs, or to some point on that railway farther to the west.

The Tonnage of Richmond & Alleghany Railroad for the year 1882, kindly prepared for *The Virginias* by Gen. Fr. Agt. B. S. Barbour, was as follows, by articles and in 2000 lbs. tons:

	East.	West.
Iron ore	7,237 tons.	24,715 tons.
Pig iron	3,483 "	1,098 "
Coal	18,022 "	3,891 "
Salt	40 "	1,106 "
Stone	14,345 "	6,842 "
Leaf tobacco	3,553 "	199 "
Wheat	7,391 "	345 "
Corn	4,289 "	1,729 "
Oats	749 "	394 "
Bacon	1,939 "	1,141 "
Hay	2,164 "	734 "
Sumac	1,613 "	85 "
Wood	6,820 "	6,020 "
Bark	10,920 "	2,565 "
Lumber	17,640 "	7,080 "
General merchandise,	68 727 "	59,506 "
Flour	24,504 Bbls.	14 578 Bbls.
Cement	4,655 "	1 840 "
Lime	46,640 "	4 618 "

Besides the articles above enumerated, this railway transported large quantities of manufactured tobacco, cotton, rye, shucks, cattle, hogs, sheep, slate, fertilizers, etc.,—most of them as well as those of the table, the products of the rich mineral, agricultural and forestal region in Virginia, tributary to its line.

The noteworthy features of this exhibit are: the shipment of large quantities of most of the articles in both directions; the important tonnage of agricultural and forest products; and the large traffic in lime and cement.

Few railways have near them better quarries of granite, slates, hydraulic and other limestones, or larger deposits of iron, manganese and other ores, than the Richmond & Alleghany RR.; and we are pleased to observe from these returns that they are begining to be developed.—We shall have more to say upon this subject in our next issue, when we shall publish a new map of the line of this railway, from actual surveys, now in preparation.

The Iron Ores of the Valley of Virginia.

By A. S. McCreath, Chemist of 2nd Geol. Survey of Pa.

[A paper read at the Roanoke, Va., meeting of Am. Institute of Mining Engineers, June 4, 1883]

The Valley of Virginia, extends from the Potomac river to the Tennessee line, a distance of about 330 miles. This section forms part of the great limestone valley which traverses in an unbroken line the states of New York, New Jersey, Pennsylvania, Maryland, Virginia and Tennessee. In New York it is called the Walkill valley; in eastern Pennsylvania the Kitatinny valley; in middle Pennsylvania the Lebanon or Cumberland valley; in Virginia the Shenandoah valley, the James River valley, the Roanoke valley and the New River valley, and further south the East Tennessee valley.

The Valley itself varies in width from 10 to 20 miles, and its floor is composed of two different kinds of rock, limestone and slate, separated from each other by an irregular line running along the middle of the valley, its whole length; the limestone land stretching to the foot of the South mountain, or Blue Ridge, and the slate land stretching to the foot and up the slope of the North mountain.

The North mountain consists of Upper Silurian rocks,—Oneida conglomerate and Medina sandstone, formation No. IV; except in Southwestern Virginia, where,by reason of the great upthrow faults, the Vespertine or Pocono sandstone, formation No. X, makes the North or Brushy mountain.

It will be sufficient, however, for my present purpose to consider only the two great geological formations: No I, the Primal or Potsdam sandstone formation; and No. II, the Lower Silurian limestone formation; for it is in these that nearly all of the ores which I have examined occur.

Ores of Formation No. I.—The Primal or Potsdam sandstone formation consists of conglomerates, sandstones and slates, and it may be conveniently divided into (1) lower slates, (2) sandstones, and (3 upper slates.

First. In the lower slates, or those geologically underneath the Potsdam sandstone, occurs a red hematite ore, sometimes in beds of considerable thickness and of good quality. This is the so-called "specular ore" of the Blue Ridge, and it has been quite extensively developed at numerous points, notably in Botetourt and Bedford counties. In northern Virginia the ore is generally very lean, being little better than a ferruginous sandstone. But over large areas it is a fairly rich ore carrying from 40 to 45 per cent metalic iron, with the phosphorus varying from .25 to .60 per cent. The silicious matter varies from 25 to 35 per cent, and consists for the most part of small grains of quartz. The ore occurs in beds varying from 18 to 48 inches in thickness, although beds of much greater thickness have been reported The following is a complete analysis of a sample of this ore from the "Pollard cut" on the Arcadia furnace property in Botetourt county:

Protoxide of iron	1.221
Sesquioxide of iron	55.928
Sesquioxide of manganese	.043
Alumina	1 808
Lime	.730
Magnesia	.706
Sulphuric acid	.007
Phosphoric acid	.607
Water	3.144
Silicious matter	38.690
	99.884
Metalic iron	40.100
Metalic manganese	.030
Sulphur	.003
Phosphorus	.265
Phosphorus in 100 parts iron	.660

Second. In the Potsdam sandstone itself, important beds of iron ore have been observed. The ore is generally a close-grained brittle dark brown hematite, invariably cold-short. In Rockbridge county a bed of it fully ten feet thick is exposed for a considerable distance on the Vesuvius property.

The ores from this horizon will probably average 50 per cent metalic iron, with about one and a quarter per cent phosphorus. Their composition is such that they are peculiarly adapted to the manufacture of pig iron for conversion into steel by the Basic process; as it has been found that a pig iron with about two and one-half per cent phosphorus gives the most satisfactory results. The following complete analysis of a sample from "Coldshort" bank on the Vesuvius property, Rockbridge county, will show the ultimate composition of the ores of this horizon:

Sesquioxide of iron	74.893
Sesquioxide of manganese	433
Sesquioxide of cobalt	.030
Oxide of zinc	None
Alumina	1 005
Lime	.740
Magnesia	.360
Sulphuric acid	.012
Phosphoric acid	3 357
Water	11 318
Silicious matter	8.050
	100,198
Metalic iron	52 425
Metalic manganese	302
Sulphur	.005
Phosphorus	1.466
Phosphorus in 100 parts iron	2 796

Third. The upper slates, however, are by far the most important from an economical stand-point, forming, as they do, one of the richest depositories of brown hematite iron ore in Virginia. They intervene between the Potsdam sandstone and the base of the Calciferous limestone, and they are found all along the western slope of the Blue Ridge,—being geologically co-extensive with it. They are generally more or less disintegrated or decomposed into variegated clays; and while they may not always carry a continuous ore-bed, yet wherever the formation exists deposits of iron ore of greater or less extent may be confidently looked for.

It is this horizon which has supplied a large amount of iron ore to the blast furnaces of Pennsylvania, and it has been the source of practically the whole of the stock of the old charcoal furnaces of the Shenandoah valley;—to the Shenandoah Iron Co's furnaces, from the noted Smith and Fox Mountain ore-banks in Page and Rockingham counties; the old Mt. Torrey furnace in Augusta; Cotopaxi, Buena Vista, Vesuvius and Glenwood furnaces in Rockbridge; and the Arcadia and Cloverdale furnaces in Botetourt county. The new modern coke furnace recently established at Roanoke by the Crozer Steel and Iron Co. will also be supplied with ores found in this formation at the company's mines in the so-called Cloverdale ore belt.

It would be tedious to mention all the localities where large deposits have been developed and are now being successfully worked; and the increased railroad facilities afforded by the completion of the Shenandoah Valley RR. will doubtless be the means of greatly stimulating their further development by more thorough and systematic methods of mining.

The average character of the ore is good, and in some localities it is exceptionally fine. The average of 31 carefully selected samples shows the following: Metalic iron, 49.956; phosphorus, 0.399; silicious matter, 12.459. The iron varies from 38.95 to 56.55 per cent, and the phosphorus from .061 to 1.266 per cent. Eighteen of the samples show consider-

ably over 50 per cent metalic iron, and only one sample shows less than 40 per cent.

It has been part of my duties as chemist for the Second Geol. Survey of Pa., to sample and analyze every important deposit of brown hematite ore that has been opened up along the flank of the South mountains in Pa.—which is simply a continuation northwards of this same belt. The average of 46 samples from the Cumberland valley shows: Metalic iron, 42.95; phosphorus, .464 per cent; and it is believed that the brown hematite ores at present being mined in the Lehigh valley will not average over 40 per cent metalic iron in the furnace. It will thus be seen that the ores from this horizon in the Valley of Virginia rank considerably above the average.

In these upper slates are also found important deposits of manganiferous iron ores, some of which might be used in the manufacture of spiegel. The average of six samples analyzed shows: Metalic iron, 31.64; metalic manganese, 19.12=50.76 total metalic contents; with the phosphorus averaging .130 per cent. The variations are as follows: Iron, from 12.325 to 47.15; manganese, from 7.277 to 44.312; and phosphorus, from .061 to .265 per cent, with the average as stated above.

Ores of Formation No. II.—In the body of the Great limestone formation No. 2, are found innumerable caverns and pot-holes, now filled with brown hematite iron ore. Although such deposits may prove somewhat irregular, yet their extent is often very great, and they have yielded large quantities of the finest quality of ore.

In the northern part of the Valley of Virginia these limestone ores have not been developed to any great extent, but in Southwest Virginia they have furnished practically the whole of the charcoal furnaces of the district. Commencing at Mack creek near New river, and pursuing a course parallel to Poplar Camp and Iron mountains for a distance of 30 or 40 miles, they have been developed in large quantity and of remarkable purity. This is generally known as the New river-Cripple creek ore belt; and the cold blast charcoal furnaces of Wythe county, whose iron is in such good repute for car wheel purposes, draw their supply of ore exclusively from this belt.

The ore occurs generally mixed with clay in clefts and cavities in the limestones; and some of the deposits have been proven to a depth of over a hundred feet. The bulk of the ore is wash ore, and the wash material will average fully one-half clean ore. At some points, however, the workings show quite a good deal of lump ore; and this not unfrequently carries an appreciable amount of iron pyrites, which occurence may be suggestive of the origin of the ore. The superior quality of the ore is shown by the analyses of 17 samples from different localities, yielding an average of: Metalic iron, 54.514; phosphorus, 0.106; silicious matter, 7.094 per cent. The iron varies from 49.35 to 57.20; the phosphorus from .048 to .197; and the silicious matter from 3.60 to 13.93. Nine of the samples show over 55 per cent metalic iron, and only one contains less than 50 per cent; and in no case is the phosphorus over .200.

In addition to the ores already mentioned, I desire to call attention to another remarkable group of ores occuring in the Great limestone formation, and found at several points in Southwest Virginia and Eastern Tennessee, viz: red hematite and magnetic iron ores. These may be said to be as yet practically undeveloped, for the ores were found to be too refactory for the small cold blast charcoal furnaces of the district, and the lack of railroad facilities prevented their finding an outside market.

Some of the ore is a dense, fine grained red hematite, with a steel-blue color on fresh fracture, as at the Sharp, Thomas and Crockett banks in Sullivan county, Tennessee; again, it is a fine rich magnetic ore, as shown at the Ripplemead mine on New river near Pearisburg, Giles county, Va., from which about 5,000 tons have recently been mined and shiped to Harisburg, Pittsburg and other points. Sometimes the ore changes into brown hematite; and indeed all three varieties may occasionally be found in the same opening. But whether the ore be red or brown hematite, or magnetite, it seems to possess the uniform feature of being very free from phosphorus. An exception might perhaps be sometimes made to the magnetite. At some points this has been found to be more or less impregnated with the slaty material, and when this is the case, the phosphorus may run somewhat higher; for I have observed that quite an appreciable amount of phosphorus is sometimes carried in the slate. But when the ore is free from this slaty gangue, the percentage of phosphorus is invariably low; and even where the ore carries considerable slate, the phosphorus has never been found over one-tenth of one per cent. It may prove interesting to note here that the magnetite is generally strongly impregnated with carbonaceous matter, sometimes to the extent of two or three per cent.

In view of the fact that the iron ores of the Valley of Virginia are of such superior quality,—and there is sufficient evidence that they exist in large quantity,—it may well be asked why they have not been more largely developed? Two reasons may be given, and these are: 1. Previous lack of railroad facilities, and 2d, an insufficient supply of fuel for reducing the ores in the blast furnace. Although ever since early Colonial times, numerous small charcoal furnaces have been operated from time to time, producing a fine quality of pig metal, yet the lack of facilities for geting their product to market, and the gradual diminution of their fuel supply, together with the ravages caused by the late war, have not only greatly retarded their extension but have prevented the establishment of other enterprises. These obstacles, however, have now been overcome by the completion of the Shenandoah Valley RR. from Hagerstown to Roanoke,—thus affording ample railroad facilities; and by the building of the New river division of the Norfolk & Western RR. to open up the great Flat-top coal region, with its superior coking coals. The New river-Cripple creek ore belt will soon be supplied with convenient railway communication, for a branch road has already been located, and there are good prospects that the line will be built in the near future.

During the present year the two pioneer coke furnaces of the Valley have been started, and are now in successful operation. The Shenandoah Iron Company's furnace at Milnes station on the Shenandoah Valley RR. was blown in during the month of February, and it has been producing from 60 to 70 tons of coke iron per day ever since. The Crozer Steel and Iron Company's furnace at Roanoke has just been started, and it promises a successful future, for it has all the modern and improved appliances combined with an intelligent management. Both of the furnaces will draw their supply of coke (made from Flat-top coal) from the ovens of the Southwest Virginia Improvement Company at Pocahontas. This company commenced operations in February, 1882, by opening up the Nelson or Big bed of coal. They are now building 200 beehive coke ovens, and they expect to have a daily production of at least 250 tons of 48-hour coke, which output can be readily increased to meet future demands. In addition to this, they will ship a thousand tons of coal daily. Already in their preparations for regular mining, they have taken out from the various drifts some 40,000 tons of coal. The main drifts are 9 feet wide and 8½ feet high, and the mine will be worked by the double-entry system of mining. The quality of the coal is very fine, as shown by the following analysis of samples selected from five dif-

ferent points in the drift—the samples representing a complete section of the coal bed from roof to floor.

Water	932	
Volatile matter	20.738	
Fixed carbon	73.728	100.00
Sulphur	.618	
Ash	3.984	
Phosphorus	.0013	

This brief statement will suffice to show in a general way the mineral resources of the Valley. With a convenient supply of the finest quality of coke—which the Flat-top coal promises to furnish; with a great variety and abundance of excellent iron ore—which can be cheaply mined; and with good railroad facilities to markets in every direction, the iron interests of the Valley of Virginia seem assured of a prosperous future.

Coal Sections on Ohio River, W. Va.

Made by Prof. I. C. White and Students of W. Va. University, May, 1883.

Section No. I.—Taken descending Wheeling Hill, Wheeling, W. Va., to foot of 10th street:

1.	Concealed from summit of hill	30′
2.	*Coal blossom*	22′
3.	Concealed and marly shales with several thin layers of limestone	55′
4.	Light gray limestone, pure, filled with minute univalves	2′
5.	Yellow and green sandy shale	10′
6.	Shales, limestone, and concealed	15′
7.	Limestone, shaly at base	5′
8	Yellowish shales and concealed	10′
9.	Impure limestone, gray below and buff at top	5′
10.	Chocolate green shale	5′
11.	Limestone interstratified with shale	30′
12.	Limestone, pure at top but brecciated below	2′
13,	Limestone interstratified with shales	30′
14.	Shales, gray, and dark, containing plant fragments	16′
15.	Sandstone, greenish gray, micaceous	1′
16.	Shale, drab	4′
17.	Shaly sandstone	1′
18.	Thinly laminated shales, containing Calamites	5′
19.	*Coaly shale*	½′
20.	Concealed	10′
21.	Limestone, earthy, light gray	10′
22.	Concealed	20′
23.	Buffish limestone	12′
24.	Concealed, including Pittsburg coal near top	28′
25.	Sandy shales	10′
26.	Concealed to low water in Ohio river	100′
	Total	419′

Section No. 2.—Taken in descending Chapline Hill, Wheeling, W, Va., opposite the Crescent Rolling mill.

1.	Shaly sandstone and concealed from the summit of Chapline Hill	35′
2.	Sandstone, rather massive	5′
3.	Concealed	45′
4.	Shales and impure limestone	10′
5.	Sandstone, shaly, and flagy	35′
6.	*Coal*, Washington?	2½′-3′
7.	Concealed and sandy shales	60′
8.	Concealed	40′
9.	*Coal*, Waynesburg?	2′
10.	Concealed	5′
11.	Flagy sandstone, filled with plant fragments	4′
12.	Concealed	4′
13.	Limestone, shales and concealed	60′
14.	Sandstone, massive, gray	5′
15.	Limestone and concealed	20′
16.	Green shale	5′
17.	Limestone interstratified with shale	55′
18.	Coal, Sewickley: *Coal* 1′; Sandy shale with plants 12′; *Coal* 0′8″	13′8″
19.	Shales	8′
20.	Sandstone, rather massive, very micaceous, current beded	20′
21.	Limestone, impure, flagy, filled with fossil ferns and other plants	1′
22.	*Coal*, Redstone	0′ 10′
23.	Mostly limestone, buff, impure	55′
24.	*Pittsburg coal*: coal 2′; shale 2′; coal 5′	9′
25.	Fire-clay	5′
26.	Sandy shale, gray	20′
27.	Lower Pittsburg sandstone, massive	25′
28.	Shales, gray, soft	10
29.	Concealed to low water in Ohio river	40′
	Total,	600′6″

Section No. 3.—Taken near the mouth of Big Grave creek, one mile below Moundsville, Marshall co., W. Va.

1.	Concealed from top of hill	30′
2.	Limestone in three layers, interstratified with shales,	5′
3.	Red and variagated shales	45′
4.	Yellowish, sandy shales	10′
5.	Massive sandstone, yellowish brown	5′
6.	Red shale, mostly at top, and containing iron nodules at 10′-15′ above the base	45′
7.	Sandstone	2′
8.	Concealed	20′
9.	Hard sandstone	3′
10.	Concealed	10′
11.	Red shale	10′
12.	Brown, sandy shales	12′
13.	Sandstone, rather massive	8′
14.	Drab shales, filled with fossil plants	10′
15.	Concealed	10′
16.	Limestone, impure, and concealed	10′
17.	Limestone, shaly	5′
18.	Concealed	5′
19.	Sandstone, hard, gray, micaceous	1′
20.	Concealed	3′
21.	Gray limestone, rather pure	10′
22.	Concealed	20′
23.	*Coal*, Washington, large blossom, covering a vertical interval of several feet, with shale in center	10′
24.	Shales and sandstone	13′
25.	Concealed	40′
26.	Limestone, rather pure, visible	1′
27.	Concealed	15′
28.	Flagy sandstone, micaceous	6′
29.	Greenish shale and shaly sandstone	20′
30.	Concealed	8′
31.	Limestone	2′
32.	Shale	1′
33.	*Coal, Waynesburg*: Coal, impure 0′6″; Shale 1′0″; *Coal* 1′6″	3′
34.	Shale, soft, gray	5′
35.	Massive sandstone, gray, micaceous	20′

36.	Concealed with limestone layer 2′ thick near base	20′
37.	Flagy sandstone and sandy shales	20′
38.	Concealed	10′
39.	Limestone	1′
40.	Concealed	14′
41.	Limestone, gray	22′
42.	Concealed to mouth of oil and gas well at 30′ above low water in Ohio river	28′
	And the section continued by the well record is as follows:	
43.	Conductor hole	18′
44.	Limestone, light gray	40′
45.	Slate	15′
46.	Black rock	10′
47.	*Coal*, Redstone	1′6″
48.	Fireclay	7′
49.	Hard slate	4′
50.	Gray limestone	20′
51.	"Bastard" limestone	10′
52.	*Coal*, Pittsburg	6′
53.	Blue rock	40′
54.	Sand rock	35′
55.	Black slate	29′
56.	"Shell" rock	4′
57.	White sandstone (Morgantown)	70′
58.	Red rock	50′
59.	White sandstone	25′
60.	Black slate	14′
61.	Blue rock, soft	15′
62.	Red rock	33′
63	"Soapstone"	14′
64.	Red rock	10′
65.	White sandstone	20′
66.	Black slate	90′
67.	Red rock	80′
68.	"White slate"	25′
69.	White sand, gas and smell of oil	20′
	Total	1,302′6″

Section No. 4,—Taken on the Ohio side just below the mouth of Pike creek, and 4 miles below Moundsville, W. Va.

1.	Red shales and concealed from top of hill		50′
2.	Gray shales, sandstone and concealed		95′
3.	*Coal blossom, Washington*		
4.	Concealed		50′
5.	Massive sandstone		13′
6.	Concealed		25′
7.	Limestone		2′
8.	Concealed		30′
9.	*Coal*, slaty at top, *Waynesburg*		4′
10.	Concealed, limestone and shales		55′
11.	Bituminous slate, fissile (Uniontown coal?)		1′
12.	Limestone, good, in several layers		10′
13.	Concealed with show of much limestone		100′
14.	*Coal* and coaly shales		2′
15.	Sandstone		12′
16.	*Coal*, Sewickley	coal	0′4″
		shale	1′0″
		coal	0′2″
		sandy shale containing plants	5′0″
		slaty coal	1′8″
		shale	0′4″
		coal	1′0″
		black slate	0′4″
			10′
17.	Limestone and shales		22′
18.	*Bituminous shale* (Redstone coal)		1′
19.	Limestone, and concealed to bed of the Ohio river,		25′
20.	*Pittsburg coal*		6′
	Total		513′

Virginia Pyrites.—In a letter to the Engineering and Mining Journal of New York, of June 23, over the initials W. H. A., which we recognize as W. H. Adams, who is now interested in the development of the pyrites deposits near Tolersville on Ches. & Ohio Ry., we find the statement made that some 200 tons of pyritous ores are now daily burned for sulphuric acid at eight different points in Mass., Conn., N. J. and N. Y., and that sulphur from pyrites can be made at about the same cost as from imported brimstone.—We take the following items from this letter:

"The principal demand for surplus low-grade acids (the making of which justifies large acid plant) has been and will continue to be, for manufacture of superphosphates, the bulk of which is sold south of Baltimore. So wide has been the price of acid made from brimstone here and from pyrites abroad, that annually tens of thousands of tons of rock phosphates have been sent to Europe for treatment, and then returned to us for use on our exhausted soils. The freight alone on this double shipment is all the profit our agricultural people should be made to pay; and the strange fact remains, that midway between the sections of greatest production in acids and greatest production in superphosphates, there are deposits of the choicest pyrites ever found in quantities, so pure as to rival brimstone in acid-making properties, yet utilized to a very limited extent.

It would be safe to say that ores from these deposits in Virginia can be laid down in every city from New York southward at prices which will guarantee commercial acid, (66° B.) at one cent per pound from this time on, and this reduction should affect the price of superphosphates at least 30 per cent from established rates. Assuming 250,000 tons of fertilizers are consumed annually, costing to average forty dollars per ton, this saving which should go to farmers, would be so enormous as to double the consumption in a short time, and as a result larger chamber capacity would be required than now used. The increase naturally would be placed nearer to consumers, thus shifting the balance of trade southward. The outlook for the acid trade is certainly encouraging; but pyrites must from henceforth be the material for its manufacture. What has heretofore been a side issue in our mining industries will now come to the front in such grand proportions as to astonish people unacquainted with productions of European mines.

Should the manufacturers combine, becoming owners of the pyrites deposits, as is the case with the Rio Tinto and Tharsis mines, there will be seen in this country products exceeding those famous properties, and that within a few years. The fertilizer trade of the south would alone warrant such development, outside of the encouraging demands of our country generally. So rapidly is the public becoming awakened to a realization of this new but permanent industry in mining that the change will be upon us before we are aware, and a mineral product will be added to the natural wealth of the eastern slope, rivaling the mine products of the west. Even Europe can be supplied with pyrites at less rates than are paid for Spanish ores; and with the large working of such deposits along our seaboard, a new impetus will be given to trade channels into which sulphuric acid enters."

The Ensign Mfg. Co. of Huntington, W. Va., on Ches. & Ohio Ry. and the Ohio river, is, we are gratified to be able to say, doing a very prosperous business. It manufactured 1,016 cars during the year ending May 1, 1883. It has just completed an order for 130 cars for a Mexican railway, and commenced one for 400 twenty-ton cars for the New York, Penn. & Ohio Ry. Its capacity is 15 cars per day. It has superior facilities for obtaining materials for its work from the forests, mines, furnaces, etc., of Virginia and West Virginia.

The Huntington Advertiser of June 23, has the following item :—"General Manager Smith, of the C. & O Ry., spent Friday in our city looking at the shops and affairs of the company. We learn that negotiations are about consummated for a contract for 500 box cars for the C. & O., to be made by the Ensign Manufacturing Company of this city."

Gold in West Virginia.—Our West Virginia neighbors have discovered gold-bearing quartz in their territory and it is likely that the old forty-niners will be superceded by those of eighty-three. Ira Schockey resides about four and a half miles from Queen postoffice, in Upshur county. He suspected that the rock was valuable, and had it assayed by a competent mineralogist, who reports that it is rich in gold and has some silver. The discovery is creating considerable excitement in the vicinity, according to letters. Dr. J. J. Mason, postmaster at Queen, and a leading physician, writes that he has seen the certificate of assay, which was from a surface lead, and it is evident that gold is to be found there in paying quantities. Dr. Mason has specimens of the quartz at the Queen postoffice.—*Keystone Courier.*

The Virginia Slate Mining Co. is now successfully engaged in quarrying an excelent quality of roofing slate from its 4040 acres tract at Snowdon, near Rope Ferry station of Richmond & Alleghany RR., Amherst county, Va., 24 miles west of Lynchburg, where it has a bed of slate 3 miles long and ¾ of a mile wide. These slates are on the eastern slope of the Blue Ridge and very convenient to the railway; the samples that we have seen are of first rate quality. We are pleased to hear of the successful development of a slate quarry at a point so near to the great Valley and to two important lines of railway.—The officers of the company are: Chas. E. Heald, president, J. W. Carroll, vice-president, R. H. T. Adams, secretary and treasurer; all of Lynchburg, Virginia.

The Great Kanawha Colliery Co. has about completed its superior works near Armstrong creek of Great Kanawha, on Ches. & Ohio Ry., and expects to ship 1,000 tons of Kanawha coal a day about the 1st of July; it is negotiating for the construction of 100 of Soldenhoff's Coppee coke ovens. Mr. S. G. Phillips is the general manager of this new English coal company.

The Morris Creek Coal Mines, those of M. T. Davis & Co., Carver Brothers, and Mt. Morris, on Morris creek, Fayette county, W. Va.. and near Great Kanawha river and Chesapeake & Ohio Ry., are now producing daily about 700 tons of superior gas coal. Few mines on the Kanawha are worked more steadily than these.

At Ingham station, Shenandoah Valley RR., Page county, Va., Mills & Co. are shiping 10 car loads of iron ore per week. Their mine is reached from the station by a tramroad one mile in length. They will shortly double their production. This ore is shiped to Dunbar furnace, Pa.

West Virginia University.—We have received the catalogue of this flourishing state institution for the year 1882-3, the 16th of its existence, as it was established in 1867. It appears from this that the West Virginia University is now conducted on the Jeffersonian plan of distinct schools and elective studies that has proved so well suited for higher education at the University of Virginia Its course of study embraces the eight academic schools of metaphysics, mathamatics, ancient languages, modern languages, English, geology and natural history, history, and agriculture, chemistry and physics, and the two professional schools of law and equity, and anatomy, physiology and hygiene: it has also a military and a preparatory department and a school of vocal music; its faculty consists of thirteen professors and teachers. It is under the control of a Board of Regents, thirteen in number. The attendance in 1882-3 was 159; of these 146 were from West Virginia, 7 from Pennsylvania, 5 from Maryland and 1 from D. C.

Beautiful for situation, on the east bank of the Monongahela, at the head of navigation, is Morgantown, the seat of of this University, It is not often that one sees a more substantial and thrifty looking town. or one that has more fertile and eye-pleasing surrounding; and very rarely one that has such a clean, wholesome, and in fact, good looking population. It is just the place for a university town—but it has one drawback, it is 20 miles from a railway. Surveys have been made for a railroad to pass through Morgantown, connecting the Pennsylvania roads with the Baltimore & Ohio; if the construction of that could be secured the success of this University would be put beyond question.

We had the pleasure of attending the commencement exercises of this institution on the 14th instant, and must say that we never heard as many sensible orations and essays on a similar occasion.

Historical.—*Stonewall Jackson's Valley Campaign.*
By Maior F. Scheibert of the Prussian Army.
(From Southern Historical Society Papers for July, 1883.)

The readers of the "Southern Historical Society Papers" may be surprised that a Prussian should venture to give a notice of an American book. But I regard this work of Colonel Allan's, and the beautiful maps of Major Jed. Hotchkiss which it contains, as worthy of being held up as *a model for military stuay.*

The original development of the designs of Jackson—the many interesting details of his movements—the clearness with which the marches, manoeuvers and battles are described—the full survey of the whole military situation, and the vivid description of the state of political affairs in Washton and abroad—the settling of the numerical strength on both sides—and last, but never least, nay first to the foreign reader, the excelent maps of Major Jed Hotchkiss (which, by the way, he showed me and I greatly admired during the Gettysburg campaign of 1863,)—all combine to make Colonel Allan's book a military classic.

Hirshberg, Silesia, Prussia.

The Kennedy Manganese Ore, from the Kennedy mines, east of Stuart Draft station of Shenandoah Valley RR., at the foot of the Western Blue Ridge, by analysis of Prof. F. P. Dunnington of the University of Virginia, contained the following ingredients, and their probable equivalents:

Manganese	43.30	—Manganese, black oxide	68.48
Iron	3.88	—Iron oxide	5.54
Sulphur	0.083	—Sulphuric acid	0.207
Phosphorus	0.052	—Barium oxide	7.74
Barium	6.93	—Phosphoric acid	0.119
		Silica, water, etc.	17.69

List of Members and Associates of Am. Inst. M. Engs. present at Roanoke, Va., Meeting.—As a matter of general interest we have obtained from Secretary T. M. Drown the following list of the Members and Associates of the American Institute of Mining Engineers that attended the recent Roanoke, Va., meeting.

W. H. Adams, Cedral Mines, Villa de Musquiz, Coahuila, Mexico.
E. C. Appleton, Canajoharie, Montgomery Co., N. Y.
C. A. Ashburner, Philadelphia, Pa,
J. B. Austin, Roanoke, Va.
W. Lawrence Austin, Philadelphia, Pa.
Edward Bailey, jr.,
R. D. Baker, Philadelphia, Pa.
C. R. Boyd, Wytheville, Va.
A. F. Brainard, Low Moor, Va.
G. W. Bramwell, Flushing, N. Y.
J. H. Bramwell, Roanoke, Va.
S. M. Buck, Coalburg, W. Va.
L. Duncan Bulkley, New York City.
J. Lawrence Campbell, Liberty, Va.
R. C. Canby, Philadelphia, Pa.
H. M. Chance, Philadelphia, Pa.
James E. Clayton, Baltimore, Md.
W. S. Clayton, Baltimore, Md.
W. W. Coe, Roanoke, Va.
H. B. Colburn, Liberty, Va.
C. F. Conrad, Roanoke, Va.
Edgar S. Cook, Pottstown, Pa.
Samuel A. Crozer, jr., Roanoke, Va.
Asbury Derland, Boiling Springs, Pa.
F. P. Dewey, Washington, D. C.
E. V. d'Invilliers, Philadelphia, Pa.
H. S. Drinker, " "
T. M. Drown, Easton, Pa.
Thomas Dunlap, Amherst C. H., Va.
T Egleston, New York City.
M. Fackenthal, Hellertown, Pa.
J. W. Farquhar, Easton, Pa.
Isaac Fegely, Pottstown, Pa.
Philip L. Fox, Philadelphia, Pa.
Persifor Frazer, Philadelphia, Pa.
John Graham, jr., Pearisburg, Va.
Edward Gridley, Wassaic, N. Y.
Edward Hart, Easton, Pa.
C. Hanford Henderson,
G. C. Hewett, Winifrede, W. Va.
C. H. Hitchcock, Hanover, N. H.
H. Hollerith,
Jed. Hotchkiss, Staunton, Va.
C. B. Houston, Thurlow, Pa.
R. W. Hunt, Troy, N. Y.
William Jolliffe, Buchanan, Va.
Frank King, Van Buren Furnace, Va.
C. O. Lagerfelt, Milnes, Va.
J. S. Lane, Akron, Ohio.
Edward K. Landis, Pottstown, Pa.
N. M. Langdon, Chester, N. J.
W. A. Lathrop, Pocahontas, Tazewell Co., Va.
A, E. Lehman, Philadelphia, Pa.
James F. Lewis, Quinnimont, W. Va.
John C. Long, Richmond Furnace, Pa.
G. A. Longnecker, Dillsburg, Pa.
A. S. McCreath, Harrisburg, Pa.
Charles Macdonald, New York City.
William P. Moore, ? Denver, Col.
William G. Neilson, Philadelphia, Pa.
E. C. Pechin, Cleveland, Ohio.
Enoch Phillips, Catasauqua, Pa.
John B. Porter,
T. D. Rand, Philadelphia, Pa.
Ellen H. Richards, Boston, Mass.
R. H. Richards, Boston, Mass.
P. G. Salom, Philadelphia, Pa.
R. H. Sanders, " "
P. W. Shimer, Easton, Pa.
Albert Spies, Jersey City, N. J.
E. Gybbon Spilsbury, New York City.
John Stevenson, jr., Lynchburg, Va.
H. A. Strode, Amherst C. H., Va.
William Thaw, jr., Pittsburg, Pa.
Willard P. Ward, Savannah, Georgia.
A. G. West, Cedartown, Ga.
James Witherspoon, Pearisburg, Va.

Members, from Virginia and West Virginia, elected at the Roanoke, Virginia, Meeting, 1883.

J. B. Austin, Roanoke, Va.
W. W. Coe, Roanoke, Va.
C. F. Conrad, Roanoke, Va.
Samuel A. Crozer, jr., Roanoke, Va.
John Graham, jr., Pearisburg, Va.
G. C. Hewett, Winifrede, W. Va.
Edward S. Hutter, Houston Mines, Va.

Associates from Virginia and West Virginia elected at the Roanoke, Virginia, Meeting, 1883.

J. Lawrence Campbell, Liberty, Va.
T. W. Simpson, Roanoke, Va.
Webster D. Smith, Paint Creek, W. Va.

New Analyses of W. Va. Cokes.—Dr. Henry Froehling, analytical chemist, of Richmond, Va., under date of April 3, 1883, has kindly furnished *The Virginias* the following new analyses of cokes made on the line of Chesapeake & Ohio Railway.

	No. 1.	No. 2.	No. 3.	No. 4.
Carbon. 92.132	92.377	95.894	87.46	
Volatile matter..... 0.632	0.260	0.390	.....	
Ash..... .... 7.132	6.750	3.500	11.32	
Phosphorus..... 0.0139	0.0146	0.0096	0.029	
Sulphur.... ..... 0.487	0.535	0.563	0 69	
Moisture..... ..... 0.114	0.260	0.216	0.49	

No. 1 is of coke made in Soldenhoff Coppee coke ovens at Hawks Nest, W. Va., from Middle Measures, No. XIII, or Kanawha coal.

No. 2 is of coke made in beehive oven at Fire Creek, W. Va., from Lower Measures, No. XII, or New River coal.

No. 3 is of coke made in beehive ovens at Low Moor furnace, Va., from New River coal from mines of Wm. Beury, Cooper & Co.

As it is the fashion to have a "typical coke" we think the Low Moor coke, No. 3 of the above analyses, may be adopted as the typical New River or Lower Measures coals coke of the Virginias, as just such a coke can be made from those coals whenever proper care is exercised in the mining of the coal and the manufacture of the coke. This coke was made from the "run of the mine."

For comparative purpose we introduce above analysis No. 4 of a "typical coke" from Connellsville, Pa., given by Mr. John Fulton, E. M., in his report on "Methods of Coking," Vol. L. page 133 of 2nd Geol. Survey of Pa. The volatile matter is not given in the report, but it appears from McCreath's analyses that it ranges from 0.352 to 0.471.

Flat-top Coal of Norfolk & Western RR., is giving great satisfaction as a fuel for locomotives. In a talk with one of the locomotive engineers of the N. & W., who has had many years experience in the use of different coals and wood for steam purposes, he informed us that the coal from Pocahontas, that had been much exposed to the weather for 18 months, was more satisfactory as a steam coal than any other he had ever used. He stated that he could bank up his fire at night, on housing his engine, and that in the morning he had only to stir it up and he could have a full head of steam in 10 or 15 minutes; and then it had absolutely no clinker, as it all burned up; besides it was a clean coal to use, giving only a moderate quantity of smoke. This testimony is the same as that from all those that have used the New River steam coals from the line of the Chesapeake & Ohio Ry., which are the same coals as the Flat-top, for the past ten years.

Regular coal trains are now daily passing eastward over the Norfolk & Western from the Flat-top field. The coals on these trains present a very fine appearance, attracting the attention of every one interested in coal, as they pass, for the coal looks bright and clean and by far the larger proportion of it is in large lumps.

We regret to learn that there has been some trouble at Pocahontas with the foreign miners that the S. W. Va., Improvement Co., unwisely, in our opinion, took to that region, and are pleased to learn that the most of them have been sent away. The negroes of Virginia make the very best of coal miners, those most industrious and easily managed, as the writer knows from information obtained in gathering the mining statistics of these states for the last census, and from the unqualified testimony of all those that have used this labor There is no excuse for having any mining troubles or lack of miners, for these strong, good-natured men can be had in any desired number.

Lumbering in the Virginias.—There is a very healthy activity in lumbering operations on the waters of New river of the Kanawha both in Va. and W. Va.

On the line of New River division of Norfolk & Western RR. in Virginia and West Virginia, Messrs. Gillespie & Lindsey are now running ten saw-mills, cuting mostly white oak, for which they are paying, for the standing timber, $10 per acre or a stumpage of $2 per thousand feet. They are now filling an order from Bew, Spencer & Co., of Baltimore, Md., for 650,000 ft. of white oak car stuff for exportation.—There is a very large movement of walnut logs now going on over the Norfolk & Western and Shenandoah Val. railways.

Lumbering is also very active on the line of the Chesapeake & Ohio Ry. and it is moving large quantities of sawed lumber, logs, etc.—Some large contracts have recently been made on this road for stumpage of tulip-poplar at $4 per thousand.

The Refrigerator Cars of the Texas Continental Transportation Co. are now very prominent features in nearly every passing through-freight train of the Chesapeake & Ohio Ry., as they are painted white and are considerably larger than most of the other box cars. We recently noticed two of them, in one train, marked "Cabbages from Norfolk to Cincinnati", illustrating not only the character of the freight these cars are moving, but also suggesting that the time is rapidly coming when all the Eastern marine plain of Virginia—her Eastern-shore and all her north-and-south trending peninsulas, a region that on an average is less than a dozen feet above tide-level—will become one vast and densely peopled market garden for supplying all the northern and northwestern parts of this country with early vegetables and fruits.—This line offers very great facilities for the transportation of all perishable articles, and such as require to be kept at an even temperature in passing to market.

The Condition of Virginia blast-furnaces, Jan. 1st, 1883, and June 1st, 1883, from "The Bulletin" of Am. Iron and Steel Association, is reported as follows:

Using coke.

In blast January 1st, 1883	3
In blast June 1st, 1883	5

Using charcoal.

In blast January 1st, 1883	12
In blast June 1st, 1883	11

The number of furnaces in blast in Virginia, Jauuary 1st, 1883, was 15; and June 1st, 1883, it was 16, a net gain of one in number. But that statement does not represent the improving condition of iron manufacture here, for the one that went out of blast since January 1st, was a small charcoal furnace producing but a few tons daily, while the three that went into blast since January 1st,—Gem, Victoria, and Crozer, are now producing, daily, from 275 to 300 tons of pig iron.

In the United States since January 1st, of the furnaces using anthracite or coke or bituminous coal, 42 blew out and 25 are represented as soon to blow out; of those using charcoal 24 blew out and 2 are soon to blow out; making 103 less in blast June 1st. than January 1st.

The Virginias.

Serial No. 43. Vol. IV.—No. 7.

Staunton, Va., July, 1883.

Jed. Hotchkiss, - Editor and Proprietor.

Table of Contents.

Lock No. 2 of the Great Kanawha river, W. Va., improvement, has been let to contract for $116,716.

The U. S. Geological survey in the region between the Great Kanawha and the Big Sandy, is now being vigorously pressed by a number of topographic parties, as it was stated it would be in *The Virginias*

Central gas-well being bored at Wheeling, W. Va., we learn from the "Intelligencer" of July 23, at 830′ struck a body of salt water that speedily filled and overflowed the mouth of the well, making it necessary to case the bore hole from top to bottom before the further boring for more gas can proceed. After piercing a thick sand-rock at 840′ gas came up.

Va. Iron ores.–A trial is to be made in the mill here of Va. magnetic ores for fix. The receipts of pig iron at Huntington amount to over 500 tons daily. Ensign Manufacturing Co. is building 400 gondola cars for the N. Y., P. & O. RR. The first shipment of ore from the Rorer Iron Co. was received at Etna, last week.—*Ironton, Ohio, Register.*

The Wooden Cross-tie will never be discarded from the railway road-bed. There is nothing that will take its place so well under all conditions; it is elastic, easy of renewal, little affected by frost, and its maximum cost is much cheaper than any substance yet devised. We doubt if a metal cross-tie can be safely and cheaply used north of the fortieth parallel; we should think that the extremes of temperature common to higher latitudes would cause them to be an unstable support, particularly when exposed to the action of frost or the extreme heat of the summer sun.—*Railway Age.*

Virginia Meteorology for 1880.—From the report of the Chief signal officer of the U. S. army for the fiscal year ending June 30, 1881, which has recently come to hand, we have gathered the following facts concerning the meteorology of the four first-class stations—Cape Henry, Chincoteague, Lynchburg and Norfolk—in Va., and the one—Morgantown—in W. Va., occupied by the signal-service for the calendar year 1880, (unless otherwise stated), the meterological observations of which are summarized in this report. We have added the facts for Washington, D. C., as representing Virginia near it, in the same way; also other information for the same year embodied in this report.—The observations at all the signal-service stations are made at the same moment of time, that of Washington, D. C., not the time of the locality of the station.

Cape Henry, Princess-Anne county Va.; latitude 36° 56′ N.; longitude 76° 0′ W.; barometer 16 ft. above mean sea-level; rain-guage 14′ and thermometer 16′ above the ground.

Mean annual barometer for 7 years :
Corrected for temperature and instrumental error only.....30″.035
Reduced to sea-level.....30″.051
Mean annual temperature for seven years.....59°. 0
Mean annual rainfall for 7 years.....57″. 57

Meteorological summary for year 1880:

	7 a. m.	3 p. m.	11 p. m.	Mean.
Barometer (to sea)	30.113	30.070	30.098	30.094
Temperature	57.7	64.9	59.0	60.6
Relative humidity	75.5	62.9	72.4	70.3
Average cloudiness, 0-4	2.2	2.1	1.7	2.0

Rainfall and melted snow, in inches.....63.06
Movement of the wind, in miles.....116, 746

The winds at the above observation hours were blowing from: N. 135 times, N. E. 170, E. 53, S. E. 129, S. 119, S. W. 277, W. 55, N. W. 156, and it was calm 4 times.—The minimum velocity of the wind ranged from 31 to 60 miles an hour; it blew hardest from N. E. A rainfall of .01 inch or more occured on 102 days, and of same amount of melted snow on 4 days.—There were 15 days with thunder storms; on 6 days the maximum temperature was below 32°, and on 24 the minimum was below 32°; the early frosts were Oct. 24 and 26.

Chincoteague, Accomac county, Va.; latitude 37° 55′ N.; longitude 75° 20′ W.; barometer 18′ above mean sea-level; rain-guage 30′ and thermometer 29′ above the ground.

Mean annual barometer for year ending June 30, 1881 :
Corrected for temperature and instrumental error only.....30″.031
Reduced to sea-level.....30″.055
Mean annual temperature for year ending June 30, 1881.....52°.2
Mean annual rainfall for year ending June 30, 1881.....52″.82

This station was opened March 15, 1880, and so no complete summary for 1880 can be given.—The first frost of 1880 was Nov. 8; the last of the spring of 1881 was April 7.

Lynchburg, Campbell county, Va.; latitude 37° 30′ N.; longitude 79° 2′ W.; barometer 652′ above mean sea-level:

Mean annual barometer :
Corrected for temperature and instrumental error only for 8 yrs..29″.372
Reduced to sea-level, for 9 years.....30″.056
Mean annual temperature, for 9 years.....57°.3
Mean annual rainfall, for 9 years.....41″ 52

Meteorological summary for year 1880:

	7 a. m.	3 p. m.	11 p. m.	Mean.
Barometer (to sea)	30.127	30.056	30.102	30.095
Temperature	53.2	65.8	55.6	58.2
Relative humidity	73.4	48.2	72.0	64.5
Average cloudiness, 0-4	2.1	2.3	1.6	2.0

Rainfall and melted snow, in inches.....38.78
Movement of the wind, in miles.....28, 235

The winds at the above observation hours were blowing from: N. 28 times, N. E. 139, E. 62, S. E. 39, S. 158, S. W. 149, W. 146, N. W. 128, and it was calm 249 times.—The maximum velocity of the wind ranged from 14 to 24 miles per hour.

A rainfall of .01 inch or more occured on 127 days, and of same amount of melted snow on 11 days.—There were 15 days with thunder storms; on 4 the maximum temperature was below 32°, and on 56 the minimum was below 32°; the first light frost was Sept. 16, and the first heavy one October 19.

Norfolk, Norfolk county, Va.; latitude 36° 51′ N.; longitude 76° 19′ W.; barometer 30′ above mean sea-level; rain-

guage 52' and exposed thermometer 20' above the ground.

Mean annual barometer:

Corrected for temperature and instrumental error only for 8 yrs. 30".045
Reduced to sea-level, for 9 years ..... 30".069
Mean annual temperature, for 9 years..... 58°.9
Mean annual rainfall, for 9 years..... 52".72

Meteorological summary for 1880:

	7 a. m.	3 p. m.	11 p.m.	Mean.
Barometer (to sea).....	30.127	30.071	30.102	30.100
Temperature.....	57.5	65.9	58.1	60.5
Relative humidity.....	73.1	57.4	71.1	67.2
Average cloudiness, 0-4...	2.0	2.1	1.5	2.0

Rainfall and melted snow, in inches..... 51.84
Movement of wind, in miles..... 62. 660

The winds at the above observation hours were blowing from: N. 183 times, N. E. 156, E. 73, S. E. 63, S. 151, S. W. 205, W. 80, N. W. 78, and it was calm 109 times.—The maximum velocity of the wind ranged from 20 to 32 miles an hour.

A rainfall of .01 inch or more occured on 112 days, and of same amount of melted snow on 2 days.—There were 16 days with thunder storms, 5 on which maximum temperature and 29 on which minimum temperature was below 32°; the first heavy frost was Nov. 16, and the next heavy one Dec. 14.

Washington, D. C.; latitude 38° 53' N.; longitude 77° 1' W.; barometer above mean sea-level 105'; rain-guage 51' and exposed thermometer 44' above the ground.

Mean annual barometer:

Corrected for temperature and instrumental error only, for 8 yrs. 29".958
Reduced to sea-level, for 10 years..... 30".062
Mean temperature for 10 years ..... 55°.2
Mean annual rainfall for 10 years..... 42".34

Meteorological summary for year 1880:

	7 a m.	3 p. m.	11 p.m.	Mean.
Barometer (to sea).....	30.131	30.067	30.108	30.102
Temperature	50.6	62.9	53.4	55.6
Relative humidity	76.4	52.3	73.4	67.4
Average cloudiness, 0-4...	2.3	2.2	1.8	2.1

Rainfall and melted snow, in inches..... 38.83
Movement of wind, in miles..... 56, 911

The winds at the above observation hours were blowing from: N. 146 times, N. E. 87, E. 52, S. E. 70, S. 234, S. W. 94, W. 85, N. W. 265, and it was calm 65 times.—The maximum velocity of the wind varied from 21 to 28 miles an hour.

A rainfall of .01 inch or more occurred on 117 days; and melted snow to same amount fell on 16 days.—There were thunder storms on 16 days, auroras on one, a maximum temperature below 32° on 15 days and a minimum below 32° on 81 days. The first frost was Oct. 1.

Morgantown, Monongalia county, W. Va.; latitude 39° 36' N.; longitnde 79° 52' W.; barometer above mean sea-level 963'; rain-guage 1' and exposed thermometer 10' above the ground.

Mean annual barometer for 7 years:

Corrected for temperature and instrumental error only,..... 28".986
Reduced to sea-level..... 30".024
Mean annual temperature for 7 years..... 53°.8
Mean annual rainfall for 7 years..... 46'.47

Meteorological summary for 1880:

	7 a. m.	3 p. m.	11 p.m.	Mean.
Barometer (to sea).....	30.087	30.012	30.065	30.055
Temperature.....	50.7	61.2	52.4	55.0
Relative humidity.....	76.6	55.6	75.3	69.2
Average cloudiness, 0-4..	2.3	2.6	1.9	2.2

Rainfall and melted snow, in inches..... 51.88
Movement of wind, in miles..... 52, 446

The winds at the above observation hours were blowing from: N. 77 times, N. E. 84, E. 20, S. E. 25, S. 29, S. W. 334, W. 110, N. W. 82, and it was calm 337 times.—The maximum velocity of the wind varied from 24 to 39 miles an hour.

A rainfall of .01 inch or more occured on 183 days, and one of same amount of melted snow on 34 days; there were thunder storms on 11 days; the maximum temperature was below 32° on 12 days, and the minimum below 32° on 63 days. The first frost in the fall of 1880 was Sept. 30, and the last in the spring of 1881 was March 16.

The Monongahela river, at Morgantown, was highest, 23' 3", Feb. 10, 1881, and lowest, 0, 6", May 30.

Coal and Coke Traffic of Ches & Ohio Ry., June, 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during June, 1883, and June, 1882, in tons of 2000 lbs., compiled by fuel agent, C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel.....	4,223	1,963	2,260	.....
Gas.....	38,741	27,544	11,197	.....
Splint and block...	5,748	7,470	.....	1,722
New River, &c.....	27,847	28,317	.....	470
Coke.....	7,674	6 883	691	.....
Totals.....	81,233	72,277	14,148	2,192

This shows a net increase of 11,956 tons, or over 16 per cent, in the movement for June, 1883, over that for June, 1882. Compared with the previous month, May, (See page 91) there was a falling off of 7,051 tons. The large increase in the movement of gas coal shows an increased appreciation of the unsurpassed gas-making coals of the Great Kanawha.

The distribution of the above was as follows:

	1883.	1882.
1. To C. & O. Co. for its own use.....	14,708	11,228
2. To Huntington, for West via Ohio river.....	3,531	4,144
3. On Elizabethtown, Lexington & Big Sandy RR....	921	2,537
4. On Ches. & Ohio Ry., excepting Richmond.....	12,152	2,247
5. To Richmond & Alleghany RR. at Clifton Forge..	852	845
6. To Valley RR. of Balt. & Ohio at Staunton.....	.....	.....
7. To Shen. Valley RR. at Waynesboro.....	.....	1,586
8. To Va. Midland Ry. { At Charlottesville.....	4,429	10,710
{ At Gordonsville.....	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR. June.	679	8
10. To Richmond for consumption, including tugs, &c.	10,837	10,230
11. To James River wharves for shipment.....	13,953	13,923
12. To Newport News, { Consum'n, includ'g tugs, &c.	120	.....
{ For shipment.....	21,917	14,719
Totals.....	84,233	72,277

It appears from the above that the eastward shipments of coal from the line of this railway continue to increase, that to Newport News in June 1883 having been over 50 *per cent more* than in June 1882.

The following table presents the progressive traffic from January 1 to June 30, inclusive, for 1883 and 1882:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel.....	14,767	13,245	1,562	.....
Gas.....	194,111	152,723	41,388	.....
Splint and block...	51,463	68,225	.....	16,762
New River, &c	218,818	170,390	38,428	.....
Coke.....	56,047	46,260	9,787	.....
Totals.....	525,206	450,803	91,165	16,762

The net gain of the first six months of 1883 over the same period of 1882 was 74,403 tons, or over 16 per cent, a gain shared in by all the fuels transported except splint and block coals, which are now sent westward more and more by river rather than by rail.

Table of Specific Gravity, etc., of Coke, by Prof. Fred. P. Dewey.

No.	Locality of Coke Works.	Coke,—Specific Gravity, Porosity, etc.							Coal,—Geological Position and Analyses.						
		Moisture	(1) True sp. gr.	(2) Apparent sp. gr.	(3) Per ct. of cells by volume.	(4) Volume of cells in 100 grams.	Weight per cu. ft.	Sampled by	Geological formation.	Water.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.	Analyst.
1	Broadford, Con'v'lle, Pa.	0.034	1.76	0.892	49.37	55.73	55.68 lbs.	J. H. Bramwell.	Pittsburg bed.	1.105	29.885	57.754	9.895	1.339	McCreath.
2	Connellsville, Pa.	0.053	1.74	0.926	46.92	52.35	57.81 lbs.	J. McFayden.	" "		31.36	59.62	8.23	0.784	T.T.Morrell.
3	Eagle, Kanawha, W. Va.	0.021	1.68	0.894	46.85	53.89	55.81 lbs.	T. Wharton.	Middle measures, (XIII.)						
4	St. Clair " " "	0.030	1.67	0.924	44.81	50.23	57.68 lbs.	" "	" "						
5	Quinnimont, New River	0.044	1.83	0.713	61.12	86.41	44.51 lbs.	S. Hotchkiss.	Lower " (XII)	0.41	19.99	76.87	1.94	0.79	T. Egleston.
6	Sewell, New River, W. Va	0.016	1.69	0.793	53.19	67.39	49.50 lbs.	J. C. McGuffin.	" " "	1.03	21.38	72.32	5.07	0.20	C.E.Dwight.
7	Stone Cliff " " "	0.074	1.74	0.838	51.79	62.30	52.31 lbs.	M. M. Jenkin.	" " "						
8	Fire Creek, " " "	0.078	1.83	0.820	55.12	69.05	51.19 lbs.	S. Hotchkiss.	" " "	0.61	22.34	75.02	1.47		
9	Rockwood, Tennessee..	0.192	1.69	0.935	44.81	48.55	58.37 lbs.	M. M. Duncan.	Upper " (XIV-XV)	1.75	26.62	60.11	11.52	1.49	Dewey.
10	El Moro, Colorado.....	0.114	1.69	0.919	45.75	50.39	57.37 lbs.	J. Cameron.	Laramie formation	1.14	29.97	56.32	12.57		Wells.
11	Crested Butte, Colorado	0.073	1.59	0.907	42.96	47.59	56.62 lbs.	" "	Fox Hills group	0.72	23.44	71.91	3.93		"
12	Leetonia, Ohio.....	0.047	1.49	0.770	47.59	62.23	48.09 lbs.	E. Orton.	Lower Kittanning seam	3.00	31.50	62.35	3.15	1.40	
13	Washn. Gas Wks., D. C.	0.802	1.74	0.772	55.66	75.48	48.19 lbs.	Dewey.							

No.	Coke,—analyses of							Coke,—method of manufacture.					Coke,—for and in what used.		
	Water.	Volatile Matter.	Fixed Carbon	Ash.	Sulphur.	Phosphorus.	Analyst.	Style of oven	Size.	Charge.	Yield.	Time of Coking.	Kind of Furnace	Size of Fce.	lbs. burden to 1 lb coke
1	0.030	0.460	89.576	9.113	0.821		McCreath.	Bee hive	11′ x 5′ 6″, 12′ x 6′	7,600 lbs.	63 per ct.	48 & 72 hours	Iron Blast Fce.	70′x16′	
2	0.075	0.412	88.655	10.055	0.805		"	Bee hive	11′ x 5′ 6″, 12′ x 6′	7,600 lbs.	63 per ct.	48 & 72 hours	Iron Blast Fce., &c.		
3								Bee hive							
4								Bee hive							
5			92.62	7.23	0.665	0.050	T. Egleston.	Bee hive	9′ 6″, 10′ 6″, 11′ 6″ x 6′	6,800 to 8,500 lbs.	65 per ct	48 hours.	Iron Blast Fce.	60′x16′	2.2
6			93.00	6.73	0.27		C.E.Dwight.	Bee hive	13′ x 6′	12,000 lbs.	62 per ct.	48 & 72 hours	Iron Blast Fce.	60′x11′	2.726
7								Bee hive	11′ 6″ x 6′	9,000 lbs 10,000 lbs.		48 & 72 hours			
8	0.216	0.390	95.894	3.500	0.563	0.0096	H. Frœhling,	Bee hive							
9								Bee hive	11′, 12′ and 13′ x 6′	100 bushels.		48 hours		65′x14′	
10				18.00	0.50		Wells.	Bee hive	11′ 6″ x 6′	4.2 tons.	60 to 65 per ct.	48 hours	Iron Blast Fce.	65′x16′	2.29
11				8.70	0.48		"	Bee hive	11′ 6″ x 6′	3.75 tons.	70 per ct.	48 hours	Iron Blast Fce.	65′x15′	2
12								Bee hive	12′ x 6′			72 hours	Lead Smelters, &c.	75′x16′	
13								Retorts					Iron Blast Fce. Domestic.		2

Note.—Of the above No. 1 is the average of 9 determinations, and the others of 12, for specific gravity, porosity, etc.—Of the coal analyses No. 1 is the average of 2 analyses and No. 5 of 4; the water of the coke in No. 2 and the sulphur in Nos. 10 and 11 is the average of 2 analyses.

these gentlemen having entered into a contract for these purposes, involving a large sum of money, provided the representations made to them concerning its coals, etc., were verified by a reliable expert. Accompanied by these gentlemen, Mr. Dewey made a careful exploration of this field; he also examined and measured the diamond drill "cores," described above, where they had been cut, and before they had been removed from the field.—The purchase was not made. The results of his measurements of these "cores" we give below.

Under date of July 12, 1883, Mr. Dewey writes us: "I enclose a slightly condensed copy of my notes on 'Dora.' You may use my name as freely as you choose, and you had better state that I examined the cores upon the spot, before removal anywhere. The examination was made in the air during a rain, so that the measurements cannot be considered to be nearer than one inch, and some of the rocks would be more elaborately and perhaps differently named had there been time and appliances to examine them carefully. However, as you know, the point I was considering was the presence or absence of coal, and that point I think is fully settled by the figures I have given."—The following are the measurements of the two cores by Mr. Dewey.

"No. 1.—Drill hole on top of a small hill.

1.	Soil, etc. (said to be)	5′
2.	A very much decomposed light colored rock; probably a sandstone	32′
3.	Broken silicious slate	6′ 1″
4.	Silicious slate	4′
5.	*Soft impure coal*	0′ 4″½
6.	Sandsone	1′ 8″
7.	*Soft coal*	0′ 11″
8.	Slate, broken	2′ 9″
9.	Sandstone	4′ 10″
10.	Slate; some silicious and some broken	3′ 7″
11.	Sandstone	2′ 10″
12.	Dark slate	0′ 5″
13.	*Soft coal;* top bench	0′ 10″
14.	Slate	0′ 3″
15.	*Soft coal;* bottom bench	2′ 9″
16.	Broken slate	0′ 8″
17.	Sandstone and some slate	84′ 0″¾
18.	Slate	0′ 10″
19.	*Soft coal*	1′ 0″
20.	Black slate	1′ 7″
21.	Sandstone	5′ 5″
22.	*Lump of coal*	0′ 1″
23.	Slate, some silicious and some *specks of coal*	3′ 11¼″
24.	Very hard sandstone	4′ 8″
25.	White material under sandstone	0′ 9″
26.	Sandstone	5′ 2″
27.	Slate, containing some calcite	3′ 5″
28.	Soft pliable slate *with coal*	0′ 10″
29.	From the last down to 790′, the depth attained at the time of my examination, Dec. 1881, there is an alternation of slates with a very hard and silicious sandstone, the latter greatly in excess, *without the faintest indication of coal.*"	

A comparison of the above measurements by Mr. Dewey with those of the correspondent of the "Valley Virginian" shows that the latter misrepresents the facts of the "core." He pretends to give in detail the coal beds of the 914′ core (that which Mr. Dewey made 790′), as above stated, *giving the thickness of 5 beds*, as: 1′ 1″, 1′ 9″, 3′, 8′, and 5′, respectively, and all the "very best specimens of anthracite coal ever found on this continent."—Mr. Dewey also found 5 beds of coal, but *all soft*, and but 4″½, 11″, 10″, 2′ 9″, and 1′ thick, respectively. Instead of 18′ 10″ of coal, with 3 workable beds, he found 5′ 10″½ of coal and not a bed that it would pay to mine, even if the coal were all good. Comment is unnecessary.

"No. 2.—Drill-hole in a hollow just below the other, but near the base of Narrow-back mountain.

1.	Thin soil	
2.	Sandstone with a little slate	24′ 0″
3.	*Coal*	1′ 0″
4.	Slate	3′ 0″
5.	*Coal*	0′ 2″
6.	Slate	9′ 6″
7.	Sandstone	4′ 0″
8.	*Coal*	0′ 4″
9.	Slate and a little sandstone	10′ 11″
10.	*Coal*	0′ 3″
11.	Slate	1′ 6″
12.	Slate, *with a little coal*	4′ 0″
13.	Considerable slate, a little sandstone, and 4″ *of fine coal.*	24′ 0″
14.	Mostly sandstone; a little slate	24′ 0″
15.	Sandstone to bottom of hole	24′ 0″

The above is Mr. Dewey's measurement of the core of the 167′ hole, which the correspondent of the "Valley Virginian" says "*showed exactly the same core*" as the other. Mr. Dewey's measurements show that these cores *do not agree*, No. 2 having but 4 coal beds, only one of them as much as a foot thick, proving the utter worthlessness and unreliability of this coal field, when two cores, but a short distance apart, representing complete sections of all its beds, differ as above.

A reading of the extracts concerning the No. X coals, from Prof. Rogers' later reports, which are given in this number, will convince any one that when he became familiar with these coals, throughout the Virginias, he found them crushed, variable in thickness, and worthless for commercial purposes.—We commend a careful reading of these later reports to the persons that pretend to have made a life study of Prof. Rogers' Virginia reports. Having given all that Prof. R. has written in these reports on this subject, we leave our readers to their own conclusions.

An attempt has been made, by recent publications in the newspapers, to show that the Editor of this paper reported favorably on the Dora anthracite coal-field in 1877, recommending it as a good investment for coal mining purposes. He did no such thing, as every party then interested knows; and more, he warned them that failure would attend their efforts to get a commercial anthracite coal there—as it did, after an expenditure of large sums of money. Others represented favorably, he did not, as a proper reading of his report will show.

Sale of W. Va. Coal and Timber land.—Messrs. Woods & Robertson have recently sold to Mr. Charles Reeder, of this city, 2,600 acres of land in Fayette county, West Va, known as the Albert Gallatin survey, and fronting four miles on the Great Kanawha river and the Chesapeake & Ohio Ry., between Gauley station and Loup creek. This land lies in the centre of the Great Kanawha coal fields, and contains several veins of excellent gas and coking coals, also fine oak and poplar timber. In addition to the transportation facilities afforded by the Chesapeake & Ohio Ry. and the river, the Ohio Central, now finished to Charleston, 40 miles below, will soon be completed to the Kanawha Falls, a short distance above, where it will cross the Great Kanawha by an iron bridge and connect with the Chesapeake & Ohio Ry. just below Gauley station. The land in that region is now bringing $20 an acre.—*Baltimore Sun, July 4, 1883.*

Notes on the Geology of West Virginia.

Written for *The Virginias*,
By Prof. I. C. White.

The annual four weeks' geological excursion from the West Virginia University was taken by the following students of the senior class: William T. Bland, Weston, Lewis county, L. M. Boyers, Randall, Monongalia county, Benj. Brown, Charleston, Kanawha county, S. B. Brown, Gladesville, Preston county, Walter Hough, Morgantown, John L. Johnston, Pentress, Monongalia county, J. G. Lazzell, Maidsville, Monongalia county, S. P. Wells, jr., Parkersburg, Wood county, and Clement L. Eakin, Wadestown, Monongalia, county, James W. Hartigan, Piedmont, Mineral county, special students in geology.

The route chosen was as follows: From Wheeling we passed down the Ohio river in a row-boat for 200 miles to Point Pleasant, at the mouth of the Great Kanawha; thence by steamer to Cincinnati and returned to the Great Kanawha valley where several days were spent in studying the Kanawha and New River coals; from the New River country we took the Chesapeake & Ohio Ry. to Clifton Forge, and thence down the James river over the R. & A. RR., stoping at the Natural Bridge, Balcony Falls, and Richmond. From the latter place a two days' excursion was made to Newport News and Fortress Monroe. Returning to Waynesboro, we passed over the Shenandoah Valley RR., stoping at Luray Cave, and thence home to the University over the B. & O. RR., reaching Morgantown, May 30th, after an absence of 26 days.

The class and myself are under many obligations to Maj. Hotchkiss of *The Virginias*, Gen. Manager C. W. Smith of the C. & O. Ry., Vice-president Axtell of the R. & A. RR., Gen. Pass. Ag't Pope of the Shen. Val. RR., the officers of the Ohio Central, State Auditor Miller of Wheeling, and to Capt. Tompkins of the Steamer Virgie Lee, for favors in geting and granting passes, and reduced rates of transportation.

We are also indebted to the Hon. S P. Wells of Parkersburg, Dr. James Stewart of Raymond city, Judge Brown and sons, and G. W. Craig of Charleston, Mr. Robt. Hutchinson of Point Pleasant, Mr. G. W. Moredock of Hartford City, and to the Messrs Valentine of Richmond, for many kind favors.

Between Wheeling and Point Pleasant a special study of the Ohio river geology was made with the view of learning the approximate position of the *Pittsburg coal*, with reference to the river level, after the former dips below the latter near Benwood. In this attempt to keep hold of the Pittsburgh coal horizon we were in the main successful, and as this portion of the Ohio river is almost an unknown field to the geologist, owing to the rarity of Prof. Wm. B. Rogers' reports, the sections taken on our trip will be given in detail, in this and future numbers of *The Virginias*.

No. I. The Pittsburg coal and its associated rocks from Wheeling southward along the Ohio river.

The great Pittsburg coal bed, No. 8 of the Ohio Geological survey, is first caught in the Ohio river hills near Steubenville as we descend that stream from the northern line of West Virginia, and has long been mined there at an elevation of nearly 500 feet above the river. From this point, however, the coal dips southward at an average rate of 20 feet per mile, thus constantly approaching the level of the river, until at Wheeling, 20 miles below Steubenville, the coal is only 100–130 feet above the water. Followed southward from Wheeling this coal continues to approach the Ohio river, and about five miles south from that city, it finally sinks below the water, and does not reappear again along that river until we come to the vicinity of Hartford City, 160 miles below Wheeling. What becomes of the Pittsburg coal under this wide intermediate area? Does it continue in an unbroken sheet between the two points, and if so, at what depth could it be reached by shafting at the various points? or does the coal disappear over any considerable portion of this territory? These are questions that naturally arise to any one who owns property along the Ohio river, or who realizes the immense importance of this Pittsburg coal to any region where it can be mined with success. These questions and their answers will be considered in the course of the following pages. To do this systematically we shall begin with a study of the rocks in the hills at Wheeling, and by comparing them with those exposed at other localities down the Ohio river, may be able to throw some light on the questions proposed.

The following Section, No. 1, exhibits the structure of the rocks as observed in descending Wheeling hill to the head of 10th street, and thence to the Ohio river.

1. Concealed from summit of hill	30′	
2. *Coal blossom, Waynesburg*	2′-3′	
3. Concealed and marly shales with several thin layers of limestone	55′	Interval from the Waynesburg coal to the Pittsburg. 250′
4. Light gray limestone, pure, filled with *minute univalve fossils*	2′	
5. Yellow and greenish, sandy shales	10′	
6. Shales, limestone and concealed	15′	
7. Limestone, shaly at base	5′	
8. Yellowish shales and concealed	10′	
9. Impure limestone, gray below and buff at top	5′	
10. Chocolate green shale	5′	
11. Limestone interstratified with shale	30′	
12. Limestone, pure at top but brecciated below	2′	
13. Limestone interstratified with shales	30′	
14. Shales, gray, and dark, containing plant fragments,	16′	
15. Sandstone, greenish gray, micaceous	1′	
16. Shale, drab	4′	
17. Shaly sandstone	1′	
18. Thinly laminated, sandy shales containing *Calamites*	5′	
19. *Coaly shale, Redstone*	0′6″	
20. Concealed	10′	
21. Limestone, earthy, light gray	10′	
22. Concealed	20′	
23. Limestone, buffish	12′	
24. Concealed, including *Pittsburg coal* near top	28′	
25. Sandy shales	10′	
26. Concealed to low water in Ohio river	100′	

A more complete section was obtained in descending Chapline hill to Wheeling creek, near the Crescent Rolling mill, as follows, (Sec. 2):

1. Shaly sandstone and concealed from the summit of Chapline Hill	35′	No. XVI Permian. 233′
2. Sandstone, rather massive	5′	
3. Concealed	45′	
4. Shales and impure limestone	10′	
5. Sandstone, shaly and flagy	35′	
6. *Coal, Washington*	2½′-3′	
7. Concealed and sandy shales	60′	100′
8. Concealed	40′	

9. *Coal Waynesburg*	2′		
10. Concealed	5′		
11. Flagy sandstone filled with plant fragments,	4′		
12. Concealed	4′		
13. Limestone, shales and concealed	60′		
14. Sandstone, massive, gray	5′	158′	No. XV, or Upper (287′) Coal Measures.
15. Limestone and concealed	20′		
16. Green shale	5′		
17. Limestone interstratified with shales	55′		
18. *Coal, Sewickley* coal	1′0″	13′8″	
sandy shales with plants	12′0″		
coal	0′8″		
19. Shales	8′		
20. Sandstone, rather massive, micaceous, current-beded	20′	29′	
21. Limestone, impure, flagy, filled with fossil ferns	1′		
22. *Coal*, Redstone	0′10″		
23. Limestone, mostly buffish and impure	55′		
24. *Pittsburg coal* coal, roof	2′	9′	
shale	2′		
coal, main bench	5′		
25. Fireclay	5′		
26. Sandy shales, gray	20′		
27. Sandstone, massive, Lower Pittsburg	25′		
28. Shales. gray, soft	10′		
29. Concealed to low water in Ohio river	40′		

In making these sections as well as the others along the Ohio river, the measurements were made and carefully re-checked in every case with one of Hicks' best aneroids, so that the total cannot differ more than 5–10 feet from the exact vertical heights; and in this connection it is interesting to note the almost complete agreement between section 2 and the one taken in the same locality by Messrs. Briggs and Townsend of the Rogers' survey, and recently published in *The Virginias*.

The identification of the Washington and Waynesburg coals made in these sections are based on the observations made further down the Ohio river, since neither is mined in the vicinity of Wheeling, and their thickness could only be estimated from the size of their "blossoms," or decomposed outcrops. As evidence for the correctness of the indentifications here given, however, it should be stated that both of these coals were traced southward until several hundred feet of the Permo-Carboniferous beds come into the hills above them, and that with the exception of a small *coal streak* at 245 feet above the uppermost coal bed (Washington), no coal whatever was found above the latter in the entire interval exposed, which was nearly 500 feet. Now as the Washington bed is one of the most persistent of the series in Monongalia and Marion counties and over all of southwestern Pennsylvania, it seemed improbable that it should totally disappear from the section, since in Washington county, not 20 miles from Wheeling, the same bed is 7-10 feet thick. Then too, this No. 6 of Section 2, is mined several miles below Wheeling, and was there found to possess a structure and quality exactly like the Washington coal, as exhibited in West Virginia and S. W. Pennsylvania, so that puting all the evidence together, there seems to be every reason for believing that Prof. J. J. Stevenson was right, when he first of all identified the coals numbered 6 and 9 in Sec. 2, with the *Washington* and *Waynesburg*, respectively.

Of course these identifications involve the thining away of the 100 feet of rocks from the interval between the Waynesburg and Pittsburg coals, and 75 feet from the interval between the Washington and Waynesburg beds, but the same writer (Stevenson) has shown that all the coal measures intervals thin away rapidly in passing westward into Ohio from the Monongahela river, so that the lessened intervals are no proof against these identifications. In Greene county, Pa., and Monongalia and Marion counties, W. Va., the interval from the Waynesburg coal to the Pittsburg is about 360 feet, while that from the Washington to the Waynesburg bed is 175, and by a strange coincidence the westward thining of the intervals has removed exactly the latter amount (175′) of rock material from the section, thus leting the Washington coal down to the same vertical distance (360′) at which the Waynesburg bed is found above the Pittsburg coal along the Monongahela river. It is this singular coincidence that has thrown some doubt on the correctness of Stevenson's identification, but which, as already stated, seems now established beyond question.

It will be observed from Section 2 that the 100 feet of thining between the Waynesburg and Pittsburg coals, has all taken place within the interval between the former bed and the Sewickley coal, since the vertical distance between the latter and the Pittsburg bed, viz, 90 feet, is practically the same as on the Monongahela river.

The Sewickley coal (No. 18, Sec. 2) is represented in the Wheeling section by two thin seams separated by 12 feet of sandy shales in which occur many beautiful specimens of *Annularia longifolia*, and *Neuropteris flexuosa*. In Monongalia county the Sewickley bed is 5–6 feet in one bed, and one of the best grate coals in the state, but along the Ohio river the conditions seem to have been quite unstable during the epoch of this coal, so that rapid subsidence split it up into two and sometimes three beds, none of which are thick enough to be valuable.

The Redstone coal still holds its place in the series as No. 22 of Sec. 2, though only a streak 10 inches thick at 55 feet above the Pittsburg. In Mononglaia county it is 4–5 feet thick, and 30–45 feet above the Pittsburg.

The sandstone so often found immediately above the Pittsburg coal is not present at Wheeling, its place being filled with buffish, impure limestones and limy shales which extend down to the very roof of the coal. These limestones have a *magnesian* look and some of the layers ought to make a good quality of hydraulic cement.

The Pittsburg coal, No. 24 of Sec. 2, has very much the same structure that it presents at Pittsburg, Connellsville, Morgantown, Fairmont, Newburg, Clarksburg, Piedmont, Raymond City, and every other place where it is mined in West Virginia and western Pennsylvania. The roof coal is not taken out at Wheeling, and the main bench is not quite so thick as at the other localities named above.

The question as to what Wheeling will do for cheap fuel, when the available supply of Pittsburg coal is exhausted from her hills, is one that will interest the future capitalists of that city, and should certainly receive the thoughtful attention of those now living within her gates, for, as may be seen from the sections given, there is no other workable coal above the water-level at Wheeling except the Pittsburg.

One way in which the period of cheap fuel may be greatly lengthened, is by the discovery of Natural Gas by drilling in the vicinity of Wheeling. The rock which holds the great gas veins recently struck at Wellsburg and Brilliant, Ohio, would be found about 1500 feet below the bed of the Ohio at Wheeling, and should it prove gas-bearing there, would for many years practically supersede the use of coal in manufacturing, and thus greatly lengthen the period of the latter's exhaustion. The wells now being sunk at the Central Glass works, Martin's Ferry, and others soon to be drilled for gas within the limits of Wheeling, will soon decide the question as to whether or not gas in large quantities can be obtained in that vicinity. Should these fail, however, there are, unquestionably, large gas-bearing areas within 10-15 miles of Wheeling, in the direction of Wellsburg

and Washington county, Pa., to which the Wheeling people could afford to lay pipes for the future cheap fuel, since Pittsburg capitalists are now laying pipes 25-30 miles for the same.

But however long the time may be prolonged, it will eventually come when Wheeling must look elsewhere for coal than to her own rugged hills. Where then shall she get it? She has the choice of two methods, viz: transportation from a distance or by shafting to the Lower Coal measures which underlie the city. The same coal that is so extensively mined by shafting below the bed of the Ohio at Steubenville and southward, should be found at about 450 feet below the bed of the river in the vicinity of Wheeling, since its place in the series is 575 feet below the Pittsburg coal. In confirmation of this, the Central Glass works gas-boring reports a bed of very pure coal 6 feet thick at a depth of 474 feet. When coal is wanted at Wheeling here is an almost inexhaustible supply that can certainly be obtained by shafting, and under this coal, at moderate depths, come two other beds which can be drawn upon when wanted, so that as far as cheap fuel is concerned no city in the country has a longer hold upon this main-spring of industrial life than Wheeling.

As we pass down the Ohio river southward from Wheeling, the Pittsburg coal gradually approaches the Ohio river, and finally, about one mile below Benwood, sinks beneath its bed, and the southward dip continuing the coal is carried to nearly 100 feet below the Ohio in the vicinity of Moundsville, where it is mined by shafting on the Ohio side of the river, and found at a depth of 90 feet. It is probably 10'-20' deeper on the W. Va. side at Moundsville, since the dip is quite rapid to the east and south. The borings for gas and oil in the vicinity of Moundsville report the Pittsburg coal at a depth of 130'-140 feet, and another one 6-7 feet thick at 575 feet below the former. This last would of course be the Upper Freeport bed, or the same one that is shafted for at Steubenville.

Big Grave creek puts into the Ohio river from W. Va., about one mile below Moundsville, and a short distance south from this stream a well was bored for oil on the land of "Col." J. H. Lockwood. by Mr. L. Eisenbeis, who kindly gave me permission to transcribe the record from his note book. The boring begins just back from the river bluff and about 30 feet above the level of the water.

A steep hill rises on the West Virginia side to a height of nearly 600 feet above the Ohio river, and in descending this from Mr. S. Riggs', on its summit, the following Section, No. 3, was constructed with the oil well record:

1. Concealed from top of hill.....30'
2. Limestone in three layers interstratified with shale.....5'
3. Red and variegated shale.....45'
4. Yellowish sandy shales.....10'
5. Massive sandstone, yellowish brown.....5'
6. Red shale, marly at top, and containing *iron nodules* at 10'-15' above the base.....45'
7. Sandstone.....2'
8. Concealed.....20'
9. Hard sandstone.....3'
10. Concealed.....10'
11. Red shale.....10'
12. Brown, sandy shales.....12'
13. Sandstone, rather massive.....8'
14. Drab shales, filled with fossil plants.....10'
15. Concealed.....10'
16. Limestone, impure, and concealed.....10'
17. Limestone, shaly.....5'
18. Concealed.....5'
19. Sandstone, hard, gray, micaceous.....1'
20. Concealed.....3'
21. Gray limestone, rather pure.....10'
22. Concealed.....20'
23. *Coal, Washington*, blossom with shale in center....10'
24. Shales and sandstone.....13'
25. Concealed.....40'
26. Limestone, rather pure, visible.....1'
27. Concealed.....15'
28. Flagy sandstone, micaceous.....6'
29. Greenish shale and shaly sandstone.....20'
30. Concealed.....8'
31. Limestone.....2'
32. Shale.....1'
33. *Coal, Waynesburg* { coal, impure .....0'6" / shale.....1'0" / coal.....1'6" } 3'
34. Shale, soft, gray.....5'
35. Sandstone, massive, gray, micaceous.....20'
36. Concealed with limestone layers at base, 2' thick 20'
37. Flagy sandstone, and sandy shales.....20'
38. Concealed.....10'
39. Limestone.....1'
40. Concealed.....14'
41. Limestone, gray.....22'
42. Concealed to mouth of oil and gas well at 30' above low water in Ohio river,.....28' } 265'
43. Conductor hole of oil well record .....18'
44. Limestone, light gray.....40'
45. Slate.....15'
46. Black rock.....10'
47. *Coal, Redstone*.....1'6"
48. Fireclay.....7'
49. Hard slate.....4'
50. Gray limestone.....20'
51. Bastard limestone.....10'
52. *Coal, Pittsburg*.....6'
53. Blue rock.....40'
54. Sand rock.....35'
55. Black slate.....29'
56. Shell rock.....4'
57. White sandstone (Morgantown).....70'
58. Red rock.....50'
59. White sandstone.....25'
60. Black slate.....14'
61. Blue rock, soft.....15'
62. Red rock.....33'
63. Soapstone.....14'
64. Red rock.....10'
65. White sandstone.....20'
66. Black slate.....90'
67. Red rock.....80'
68. White slate.....25'
69. White sand in which some gas and a smell of oil were obtained near the bottom of the hole which stoped in this bed.....20'

Sumary of the above Section.

No. XVI, or Permian beds, Nos. 1-32, inclusive	395'
No. XV, or Upper Coal Measures, Nos. 33-52	274½'
No. XIV, or Barrens, Nos. 53-69	574'
Totals	1,243½'

The Upper Freeport coal cannot underlie the point at which the drill stoped at the bottom of No. 69 by more than 5'-10', since in another hole drilled about two miles

north from this, a coal 7′ thick was found at a depth of 575 feet below the Pittsburg bed.

About one mile east from the top of this section at Mr. Riggs' the hills rise about 200 feet higher, but Mr. R., who has ploughed over all of them, says he has never seen any streaks of coal in the same, but they consist of a monotonous succession of red and greenish shales, with thin limestones and some brown sandstones.

The Washington coal, No. 23, makes a large blossom on the surface at this locality, but as it has never been opened, nothing is known of its character, though from its outcrop one would judge that it has a large bed of shale near its center.

The Waynesburg coal, No. 33, is the same bed that has been mined in the vicinity of Moundsville, where it is known as the "4-foot" seam. On the Ohio side of the river it has also been mined in Belmont county, and is there, from its great irregularities, known as the "Jumping 4-foot vein." (Stevenson).

At the locality of the present section it has been laid bare by a quarry in the sandstone, No. 35, under it. Mr. Riggs once opened it along the road, which ascends the hill, and reports the coal as varying from 2½-3 feet in thickness and rather sulphurous.

The Pittsburg coal, as seen from the boring, underlies the Ohio river about 95 feet at this locality.

A short distance below the mouth of Big Grave creek, the Ohio river veers around abruptly through about 90° of arc, and instead of flowing S. 10° W. as it does between Wheeling and Moundsville, goes N. 80° W. for nearly 3 miles to the mouth of Pike creek. This abrupt change in the direction of the river's course brings the rocks rising rapidly above it, and at the mouth of Pike creek on the Ohio shore, the Pittsburg coal comes up to within 10 feet of the surface of the water at ordinary stage of the river.

A very steep hill rises from the river on the Ohio side just below the mouth of Pike creek, and in descending the same, Section No. 4 was obtained, as follows:

1.	Red shales and concealed from top of hill	50′	
2.	Gray shales, sandstone and concealed	95′	
3.	*Coal*, blossom, *Washington*		120′
4.	Concealed	50′	
5.	Massive sandstone	13′	
6.	Concealed	25′	
7.	Limestone	2′	
8.	Concealed	30′	
9.	*Coal*, slaty at top, *Waynesburg*	4′	248′
10.	Concealed, limestone and shales	55′	
11.	Bituminous slate, fissile (Uniontown coal ?)	1′	
12.	Limestone, good in several layers	10′	
13.	Concealed, with large show of limestone	100′	
14.	*Coal and coaly shale*	2′	
15.	Sandstone	12′	
16.	*Coal, Sewickley.* Coal 0′ 4″; Shale 1′ 0″; Coal 0′ 2″; Sandy shale containing fossil pl'nts 5′ 0″; Slaty coal 1′ 8″; Shale 0′ 4″; Coal 1′ 0″; Black slate 0′ 4″	10′	
17.	Limestone and shales	22′	
18.	*Bituminous shale* (Redstone coal)	1′	
19.	Limestone and concealed to bed of the Ohio river	25′	
20.	*Pittsburg coal*, reported	6′	

The Waynesburg coal, No. 9, has been mined at this locality where it is 4 feet thick, though the upper portion is rather slaty.

The Sewickley coal in the above section I have identified with No. 16, but it should also include No 14, since this entire interval (Nos. 16-14) 24′ thick, represents the epoch of the Sewickley coal bed, the section of which is a sufficient commentary on the unstable condition of affairs which prevented the accumulation of material for a valuable coal bed, the peat bog having been constantly submerged and buried with mud soon after the peat began to form, so that although nearly 6 feet of coaly material is interleaved through the 24 feet of rocks, it is all useless as a coal bed.

At very low water the *Pittsburg coal* has been mined from the bed of the Ohio at this locality, by shuting off the water with coffer-dams; it is reported as 6 feet thick.

Many people believe that the appearance of the Pittsburg coal so near the surface of the water at this locality, when it is nearly 100 feet below the river 3 miles above, is due to the great upheaval which crosses the river at the mouth of Pike creek, but this is an error, since its emergence is due solely to the change in the course of the river between the two points as already explained. In this vicinity the rocks rise west and north, and of course dip east and south, so that when the river flows west, or north of west as it does here, the rocks rise rapidly above its bed, that had diped under the same while the river was flowing south.

The Vespertine or Formation No. X Coals of the Virginias.

By Prof. Wm. B. Rogers.

In the controversy concerning the commercial value of the *anthracite*, *semi-anthracite*, and *semi-bituminous* coals that have been found in many places in Apalachian Virginia and worked to some extent,—in Rogers' Virginia formation No. X, the Vespertine Sandstone and Coal of the First Pa. Geol. survey, the 13 a. Montgomery Grits and Coal measures of the Lower Carboniferous, Sub-Carboniferous of Rogers' recent writings,—frequent appeals are made to the Virginia reports of Prof. Wm. B. Rogers (made by him as State Geologist from 1835 to 1841) as sustaining the pretensions of those that insist upon the great commercial value of these patches of irregular coals, and extracts are given from these reports that apparently warrant such pretensions.—That our readers may know just what Prof. Rogers did write and publish upon this subject, in these reports and elsewhere, we give below every portion of these reports (and we have the original editions of all his reports for reference) that we can find having any bearing on this question; to these we add his views as recorded elsewhere. The first extracts are from his "Geological Reconnoisance of the State of Virginia" made in 1855, a mere *preliminary report*, made in the very infancy of geological knowledge, in which he frequently claims the privilege of changing his views and statements if he sees fit to do so after further explorations.—*Editor.*

1. Extracts from Geological Reconnoissance of 1835,—the First Virginia Report.

On page 5, in writing of his fourth general division of the state, he mentions, as among its objects of interest, "Its anthracite, pseudo-anthracite, or semi-bituminous and bituminous coals."

On page 37, writing of the Massanutton mountains in The Valley, he says: "Rumor intimates that *coal* even has been found," and "Should coal ever be discovered in this region, it will probably be *anthracite;* and certainly the character of the rocks of the Massnutton, so far as they have yet been examined, is not *adverse*, if it be not favorable, to the opin-

ion that the search for this mineral might be attended with success."

On page 39, in writing of iron-working in The Valley, he says:

"A new interest attaches to this branch of industry, at least in some portions of the Valley, from the recent discovery in the immediate neighborhood of the iron, of beds of a semi-bituminous dry coal, which if we may trust to the indications of its composition, may hereafter be employed as a most efficient and profitable substitute for charcoal in the furnace. Of this coal as it occurs in the Catawba mountain, and at other points in the Valley, but little as yet is known; but should the hopes excited by analyses which I have recently made of specimens from the former locality, prove to be well founded, a new impulse will be given to the iron manufacture in that district of the state, and rich rewards be proffered to the enterprise of capitalists who engage in it."

On page 40 is the following general statement:—

"The region to which the portion of the profile just described refers, abounds in objects of practical as well as curious interest.

The *coals* of the Little North mountain, Catawba mountain, &c., are among the most prominent of these in an economical point of view; and should the reasonable expectations to which their discovery has given rise not be disappointed, will influence in no small degree the prosperity of one of the most extensive and important regions of the state. From the Potomac to the southwestern counties, the minor ranges of mountains, rising in general along the western boundary of the Valley, are known to include beds of this mineral in the various conditions of a pure anthracite, and a compound containing variable but never large proportions of bituminous matter, and which may accordingly be denominated semi-bituminous coal. In Berkeley county, on Sleepy creek and elsewhere, openings have been made, from which an anthracite of the very purest character is obtained. In Frederick, Shenandoah, Rockingham, Augusta, Botetourt and Montgomery, similar discoveries have been made, the coal of the four former counties, as far as yet examined, being nearly identical with that in Berkeley, while that found in Botetourt and Montgomery contains a considerable portion of bitumen, though far less than that of ordinary bituminous coal. The veins which have as yet been examined vary from three to seven feet in thickness. That represented in the profile, diping west into the Little North mountain, near Coal run, in Rockingham, is about four feet thick. Several openings at different points in the neighborhood, present no perceptible variation in the character of the coal, which is a pure anthracite, capable, as experiment has shown, of burning with but little flame, and with the production of a very intense heat. At this place, and it would appear also in others in the same range, the coal readily falls into small fragments, exhibiting numerous rubed and shining surfaces, leading to the impression, which an examination of the enclosing rocks would also indicate, that a dislocation of the strata has occured, attended with a sliding and grinding action of the roof and floor of the veins, breaking up and fissuring the included coal, and occasioning by the mutual attrition of the contiguous surfaces that peculiar lustre and striated appearance which they invariably exhibit. In some of the veins, however, this crushing effect appears to have been but little felt, and the coal comes from the vein in larger and more permanent masses. A further exploration of those veins, in which the coal has been thus reduced, may bring to light other portions of the vein, in which comparatively little of this grinding and crushing action has occured. For some purposes, this broken condition of the coal would not impair its usefulness, but for general sale it would affect its market value.

According to an analysis of the Berkeley *coal* executed by my brother, Professor H. D. Rogers, it contains in the one hundred grains only 4.94 grains of grey ash, all the remainder consisting of volatile and combustible matter. This indicates a purity exceeding that of the Pennsylvania anthracite in general, which at a mean contains about six per cent of ash.

In the *coal* from the Catawba, I have found varying proportions of bitumen in the specimens from different localities. An average of these results indicates about 14 per cent of volatile matter, chiefly of a bituminous character. This coal burns with but little intumescence or swelling, is not much inclined to cake, has no tendency to splinter when burning, and forms a large amount (upwards of 80 per cent) of a very superior kind of coke. Allusion has already been made to the probable value of this mineral, in connection with the iron manufacture of this part of the state, but further explorations of these veins, together with careful chemical analyses of the coal as well as iron ore, and actual trials of the former as to its qualities in the furnace, are yet required, in order to determine with certainty the usefulness of this coal in the raw or uncoked condition, in reference to this branch of industry. In connection with these remarks, and more especially as suggesting an important hint to those who may be endeavoring to bring these dry coals into use in the way alluded to, it may here be added, that from the great success attending the use of the *hot air blast* in France and England, where in some cases, coals in the raw state, of an analogous character, are employed, the introduction of the same mode of operation here holds out the promise of most profitable results; and it may be further suggested, that the great efficiency and economy of the *hot air*, even according to the trials made in this country with the ordinary materials used as fuel in our furnaces, ought at once to excite the attention and awaken the enterprise of all who are concerned in this highly important branch of our manufactures."

On page 43 this occurs: "Progressing westwards, the overlying slate is increased in thickness by the addition of other, and not exactly similar beds, over which, and generally diping to the west, we find the sandstones and slates on the western flank of the Alleghany mountains, as presented in the neighborhood of the White Sulphur Springs. Among the numerous ranges of similar structure to that exhibited in the profile, and which is usually denoted by the common name of Alleghany, veins of coal have been discovered in many places, and the black shale usually accompanying this mineral is of frequent occurence. One of these veins is exhibited on the profile, as seen in the vicinity of Crowe's near the base of the Sweet Spring mountain. A similar vein about three miles north of Lewisburg, furnishes a coal which according to the trials which have been made of it both in smiths' forges and in ordinary grates, has been shown to be of good quality. Most, if not all of these coals, are of the semi-bituminous character, and are, therefore, not much prone to cake while burning."

And on page 47 is the following and last mention of these coals in this preliminary report of 1835:

"Of the *coal* occuring in Montgomery, and other parts of the south-west region, nothing at present need be added, as the remarks already made in regard to the beds of the same variety of this mineral occuring in the Catawba mountain and elsewhere would be equally applicable to those found further south."

2. From Rogers' Report for 1836.

On page 8, after remarking that after much toil and perplexity "a key had been found to the intricate geology of the region west of The Valley as connected with that of The Valley inself," the following statements are made:

"The *coals* of this region were examined at numerous points from the Potomac to the neighborhood of the Tennessee line, and although much additional investigation is required to ascertain the number and extent of the workable seams of this mineral, enough has already been done to satisfy me that they will, ere long, be regarded as one of the valuable resources of this part of the state. On a former occasion I adverted to the peculiar adaptation of some of these coals in the raw state, to the *manufacture of iron.* The analyses of specimens from several localities, not visited before this season, indicate a composition admirably suited to this use. As examples of coals of this description, I will refer to the three following:

1st. The semi-bituminous coal, from Tom's creek and Strouble's run, in Montgomery county. This consists of

Carbon	80.20
Bitumen, &c	13.60
Ash	6.20

The combustible value or calorific power of 100 parts of this coal is equivalent to that of 92.5 parts of carbon.

2d. Semi-bituminous coal from near Lewisburg. This consists of

Carbon	78.84
Bitumen	14.16
Ash	7.00

The calorific power of 100 parts of this coal is equivalent to 87 parts of carbon.

3d. Catawba semi-bituminous coal—Botetourt county. This consists of

Carbon	78.50
Bitumen	16.50
Ash	5.00

The calorific power of 100 parts of this coal is equivalent to 89.4 parts of carbon.

These and similar results obtained with regard to specimens from other localities in the Apalachian region, illustrate the fitness of these coals for the manufacture of iron, a quality which must be looked upon as giving them incalculable value, when their immediate vicinity to inexhaustible supplies of iron ore is taken into the account.

The vast advantages in point of economy resulting from the employment of the *raw coals* of Wales, Scotland and France, in the *smelting of iron ores*, though not unknown in this country, appear as yet to be imperfectly appreciated. It may therefore be proper to remark, that whenever in Europe, coals of the proper character can be obtained, they are prefered to every other material used for this purpose. It is surely greatly to be desired that a trial were made of our semi-bituminous coals in the smelting furnaces, since by the result of a successful experiment of this kind, if carefully performed, a new impetus would be given to the manufacture of iron in Virginia. At the same time, the importance of applying the hot air blast, especially in connexion with the use of these raw coals, cannot be too urgently insisted upon. The large mass of experience collected of late years in Great Britain, as well as on the continent, conclusively demonstrating the great economy of this process, and the very general disposition in Europe to adopt it whenever practicable, ought to furnish a sufficient inducement for its introduction here; and since, as Berthier has shown, its advantages are augmented by connecting it with the use of raw coals, an especial motive is presented for its adoption in the furnaces of the region of which I am at present treating. Should these improvements be brought into extensive operation, as in process of time they most assuredly will, the prosperity of this vast and almost forgoten portion of the state, will outstrip anything that the imagination of its present inhabitants can conceive. What surer foundation for the permanent wealth and power of a community can be found, than the stores of coal and iron embosomed in the rocky strata of its hills and valleys, and what more efficacious stimulus to the mechanic arts, to industry in general, and to the advancement of all practical and profitable knowledge, than the multifarious pursuits linked with the *manufacture of iron?*"

3. From Rogers' Report for 1837.

The operations of the survey in 1836 had furnished Prof. Rogers the key to the structure of Apalachian Virginia, consequently in the report for 1837 his statements become positive.

On page 10, writing of the Massanutton mountain, this statement occurs:

"In that portion of the two districts in question, extending from the western boundary of the Valley limestone to the escarpment of the Alleghany rocks, research has been more especially directed to the region lying west of the Cacapon river, and of the Great Shenandoah mountain, although numerous sections have been made crossing the intervening belt. In the adoption of this course, I have been influenced by the results of former observations, leading to the conclusion that the low ranges flanking the Valley to the west could never be satisfactorily investigated until the structure of the region beyond was clearly understood. From the very remarkable geological appearances generally presented, where the most eastern of these ranges meets the Valley rocks, it became apparent during the last year, that the usual and otherwise invariable order of succession of the several members of our series of rocks was here violently interrupted, and that the limestone, one of the lower members of the group, was brought in contact with strata nearly approaching in position to the carboniferous slates and sandstones so widely extended over the region westward of the Alleghany. This line of fault, of which indications are to be met with at most of the gaps immediately west of the Valley, appears to extend with but little interruption throughout the whole length of the state, and presents a striking illustration of the stupendous violence of the forces by whose agency the strata of the Valley and of the parallel mountain chains lying to its west, have been caused to assume the positions which they now exhibit. Without entering more into detail in regard to this interesting and extraordinary feature in our geology, it will be apparent to the board, that repeated and careful observations made at various points along the line of dislocation, must be requisite to a sure determination of the point in the geological scale to which the strata thus abutting against the Valley should be refered. And the more caution is required in this investigation as these strata have in many places been found to contain an anthracite or semi-bituminous coal, and the probability of its continuity or available importance, might in some degree depend on the opinion formed of the rocks with which it is associated. While from these considerations, I directed examination chiefly to the region situated more to the west, so that in another season we might approach this tract of more perplexing difficulty with the useful lights afforded by a clear knowledge of strata whose connection we could trace with them, attention has been incidentally bestowed at several points upon the coal-bearing rocks adjacent to the Valley. The interest naturally felt in the existence of a deposit of coal appearing at many localities along the line in question, and from its vicinity to a populous and thriving region, invested with peculiar importance, renders me reluctant without much more detailed examination than I have yet bestowed upon it, to venture upon an opinion as to its actual extent, or to affirm positively its position in the geological series, as compared with the anthracite of Pennsylvania, or the bituminous coal of our western

counties. This much, however, I may with propriety declare, that though undoubtedly far less extensive than the formation in Pennsylvania, its almost unquestionable continuity in some districts, as for instance, in Montgomery, Wythe, &c., over great distances, and the available thickness and good quality of the coal here exposed, lead to the opinion that it is destined at some day to become an important item in the resources of the surrounding region. I may venture further to add, though reserving this opinion to be corrected by future observations, that from the examinations thus far made, the rocks with which this coal is associated would appear to occupy a lower place in the series than the bituminous coal measures of the west, or the shales and sandstones of the anthracite of Pennsylvania; and that they will probably, in most cases, be found to refer themselves to the most inferior member of the group. In what is here stated in relation to our anthracite and semi-bituminous coal, the board will understand me as not confining my remarks to the two districts of which I am at present treating, but as designing them to apply also to the southern district."

On page 13, writing of the southwestern portion of The Valley, he says:

"In regard to the anthracite or semi-bituminous coal exposed at various points in the district here refered to, it would be premature in the present stage of our investigations, to present any further or more decided views than have been already submited while alluding to the peculiar structure of the ranges on the western margin of the Valley. I would, however, observe that much has already been done in ascertaining its geological position and economical character, both as presented under the circumstances alluded to in the Brush or Little Walker mountain, and under somewhat different relations in the Catawba mountain and the Peaked knob of Draper mountain, as well as in some other localities in which small exposures have been discovered."

On page 22 Prof. Rogers describes Formation No. X, the one that contains these coal beds, as follows:—"This consists of rocks of very heterogeneous character, though arranged in general with remarkable uniformity. A red sandstone containing white siliceous pebbles, usually about a half inch in diameter—a grey, rather open grained sandstone, and a beautiful white conglomerate, consisting of very large pebbles, embeded in a light olive or dingy green paste—yellowish, olive and dull red micaceous soft sandstones—having something of a shaly structure, constitute the principal rocks forming this curious group. Beautiful ripple markings are often met with on the surfaces of the large slabs of the finer of these sandstones. Many of the strata of this, as well as the preceding member of the series, are remarkable for the facility with which they may be divided into thin slabs of uniform thickness, and great extent, and in virtue of this property, as well as the durable character of the rock, present an admirable material for building. The finer and harder variety, of a grey or light yellowish green color, is often used for grindstones, for which it would appear to be admirably suited. When thus cleft, the surfaces of the slabs occasionally reveal superb collections of organic markings, among which, fucoides and calamites deserve to be particularly mentioned. Laminæ of coal less than a quarter of an inch in thickness, have been remarked at several points in the more shaly strata of this group, but there is no reason to look for an important vein of this mineral among them, These rocks may be well seen near the bridge over Howard creek, on the road from the White Sulphur to the Greenbrier river, and again a little east of that river, on the road from Huntersville to the base of the Greenbrier mountain. In the latter locality the coarse conglomerates are very extensively exhibited."

4. *From Rogers' Report for 1838.*

On page 8 is the following description of Formation No. X:—"Formation X. is well distinguished by the coarse sandstones and conglomerates it contains, from the two widely expanded members of our series just described. Along with these more siliceous rocks and forming the upper part of the group are found olive, yellowish and dull red micaceous sandstones, graduating into shales, containing impressions of coal plants and thin seams of semi-bituminous coal. The association of these shales and coal in one group with the subjacent conglomerates and sandstone, is deemed both more natural and convenient than to regard them as the lower portion of the next superior formation, as from a limited examination of the rocks in question, was done in the last report. In fact the heterogeneous strata of the formation now under consideration, mark the first effort of natural causes towards the production of the extensive series of sedimentary deposits and beds of coal forming the widely expanded coal measures of the trans-Alleghany region—an effort which was interrupted for a time by the new agencies employed in the formation of the calcareous and other strata of the succeeding member of the series. It is in this formation that the semi-bituminous coal of the little North mountain, Brushy mountain, and various localities to be pointed out, occurs, and thus the comparatively limited extent of these coal strata finds a ready explanation in the fact that during their formation the widely spread strata of the *true coal measures* had not yet begun to be produced."

On page 21, after describing the great "line of fault" that continues all along the western margin of The Valley, and stating that at that fault "the slate of formation III generally lies in an inverted position on the southeastern diping rocks of the ridge (Little North mountain) which are generally formation X," the following descriptions are given:

"*Of the Semi-Bituminous Coal of Sleepy Creek, Catawba, Tom Creek, etc.*—The foregoing account of the structure of the mountain belt immediately west of The Valley will be found of essential aid in illustrating the geological relations and probable economical value of the seams of anthracite and semi-bituminous coal lying adjacent to The Valley, and of which some mention has been made in previous reports.

It has now been ascertained beyond a doubt that the coal in question does not appertain to that part of our series of formations in which are contained the anthracite of Pennsylvania and the bituminous coal of western Virginia and Pennsylvania, and of the western coal field in general, but that they are of much anterior production, being included in the *tenth* of our series of formations, whereas the others are contained in the *thirteenth*. A great thickness of slates, sandstones and sometimes limestones, corresponding to formations XI and XII, intervenes between the two series of coal deposits, the lowest of which, that appertaining to X, having been as it were but a first effort, soon arrested, and productive only of one or two *thin seams*.

The following details, derived from numerous minute observations, will sufficiently indicate the circumstances under which the coals in question are presented both in the Sleepy creek and Third Hill mountains, and in the North and Brushy mountains.

Coal of Sleepy Creek and Third Hill Mountains.—These mountains may be described as forming the sides of an elevated synclinal trough of formations IX. and X., commencing about 1½ miles north of Pughtown, and continuing nearly to the Potomac, the Third Hill compo ing its eastern and the Sleepy Creek mountain its western boundary. Throughout much of the length of the former a partial inversion of the strata consisting of IX is found to prevail for some distance up its eastern slope, evidently referible to the same

mechanical forces which were instrumental in causing the inversion of the Little North mountain a few miles to the east, and of the rocks generally of the intervening space. Opposite to Green-Spring gap in the Little North mountain both the Sleepy Creek and Third Hill mountains consist of the red sandstones and shales of formation IX, having in the former a moderately steep eastern dip, while in the latter they are vertical or steeply west diping nearly to the top. North of this the inversion of IX in the Third hill becomes decided, the dips in the other mountain continuing as before. Near where the Bath and Gerardstown road crosses the trough, the elevation of both ridges is suddenly and largely augmented by the addition of heavy overlying beds of white sandstone and conglomerate appertaining to formation X. These continuing thus for several miles, are at length united in an elevated basin, in which, resting upon the sandstone and conglomerate above described, are contained the slates and coal seam of which it is my chief object at present to treat.

At the most southern point at which coal has been discovered, about 11 miles from the northern end of the basin, an undulation or anticlinal wrinkle makes its appearance in the sandstone near the middle of the trough, and this structure is continued, forming a low broad hill, to the northern termination of the basin. At the same time the Third hill takes on a synclinal character, which it maintains nearly to its close. Thus, therefore, besides the general synclinal structure of the two mountains, there are two important rolls, which, affecting the strata containing the coal, explains the number of exposures of the same seam in a transverse section passing through the principal working near the northern end of the trough. There are four of these exposures, two on the opposite sides of the hill before mentioned and two on the Third hill.

The massive and ponderous sandstone forming the upper part of Third hill, though thrown into very steep dips, has in general escaped the inversion which affects the more flexible underlying rocks of IX.

The coal measures are well exposed near the northern extremity of the basin along the banks of Meadow branch, which for about three-quarters of a mile flows in the synclinal axis, and eventually makes its escape through the wide opening at the northern extremity of the basin, occasioned by the removal of the heavy sandstone and conglomerate by which originally the trough was there closed up. These slates and slaty sandstones, which are generally of a hard and compact texture and siliceous composition, and of bluish, greenish and gray tints, show themselves in bold cliffs on the side of the stream diping to the south in the middle, and towards the east and west sides of the basin passing into S. W. and S. E. dips, so as to mark the curving around of the extremity of the trough. A little higher up the stream we meet with the black carbonaceous shales and black siliceous sandstones containing the coal. Numerous thin layers of coal are interstratified with the shales, and the seam which has been opened at this point is in places subdivided by an interpolated band of the black siliceous sandstone. As indicated already, the other outcrops of coal, both to the east and west of this, are to be regarded as belonging to the same seam as that here exposed, and there can be no doubt that it is this which is again exposed at the upper or southern opening before alluded to. This seam presents at all the exposures a very variable thickness, but may be estimated as possessing an average width of about two feet of pure coal. This, as might be infered from the indications of violence so plainly exhibited in the structure of the surrounding region, especially that of the Third hill, has been reduced to a fragmentary state, displaying on the surfaces of spontaneous fracture marks of the pressure and attrition to which it would seem to have been subjected. The roof and floor of the seam present similar polished surfaces, and in some places have been pressed almost into contact. In such a crushed condition, the coal, though really as pure as anthracite in general, could scarcely prove of much value in the market, being unfit for the grate and most other purposes to which this class of coals is commonly applied. Unfortunately, too, there is no ground for anticipating any improvement, as the workings extend deeper into the seam. Were the broken state of the material merely the effect of *weathering at the surface*, such a hope might be entertained, but feeling assured that it is the result of *mechanical violence* accompanying the disturbance of the strata at the time when they were thrown into their present position, I entertain no doubt that this splintery character will be found pervading the seam more or less in every part.

The inversion of formation IX, already spoken of, continues after the closing of the basin, and is traceable across the Potomac into Maryland.

Coal of Narrow-Back.—Immediately in the rear of the Little North mountaim, in the counties of Shenandoah. Rockingham and Augusta, there occurs a line of fault along which the inverted rocks of this mountain are found resting upon one of the formations higher in the series. While at some places, as at the Augusta springs and Brock gap, this fault is merely a crush in formation VIII, in others it is accompanied by the disappearance of several members of the series, thus causing IV, or even III, to fall upon IX or X.

The latter condition is that prevailing along the eastern flank of Narrow-Back. This ridge, composed of siliceous conglomerates and sandstones of X diping to the southeast, is bordered along its eastern base by the slate of formation III, so that the fault here having, along with the other intervening formations, removed the massive strata of IV, the chief frame work of the Little North mountain in this district of the state, this mountain is intermited for a short distance in the neighborhood of which I am now treating. Towards the north, this rock again appearing east of the line of fault, the mountain is *reproduced*, showing itself at Cooper mountain near the Rawley springs, and in the same manner towards the south, the hiatus of rocks at the fault diminishing, IV is brought up, and eventually, at the Augusta Springs gap, exhibits all the formations from III to VIII, inclusively, but in an inverted position.

Near the western base of Narrow-Back, on the margin of Briery branch, there occurs a low ridge, consisting of grey siliceous sandstones, and dark blueish and greenish slates, appertaining to formation X. It is in these rocks that the thin *coal seam* of this locality has been discovered, whose contents, as chemically examined, were noticed in a previous report. This seam is apparently about three feet in width, but for much of this distance consists of a black glazed shale, readily mistaken for coal. As might be expected, from their contiguity to the fault above described, the coal and accompanying rocks are greatly contorted, the former being in a crushed and splintery condition, the latter displaying over extensive surfaces the polish due to a violent rubing of adjoining strata.

Coal of Catawba Creek.—The line of fault, formerly described as commencing at Crawford mountain, presents a very slight dislocation at the gap by which the Fincastle and Sweet Springs turnpike leaves The Valley. Here III and IV are seen inverted in the low ridge adjoining The Valley, the latter being at some points greatly crushed. Immediately behind we meet with VIII, which losing its inversion forms the eastern side of the synclinal ridge called Caldwell mountain, which is here caped with trough-shaped strata of IX. Continuing on to the neighborhood of the Catawba furnace, the dislocation shows itself on the flank of the mountain,

bringing III and IV with inverted dips immediately on X. The coal seam opened in the latter formation displays the same irregularity of thickness, and the same splintered condition of its contents as the preceding. It yields about 2½ feet of coal, good in composition but not in merchantable form. At other openings in the vicinity, which it is understood are in contemplation or in progress, the same condition may be confidently anticipated. Yet from the general goodness of the coal, it is hoped that a useful purpose will be answered by it in some of the operations of the adjoining furnaces. Its calorific power and chemical composition, as detailed in a former report, indicate its value as regards the material of which it is formed, and only the *crushed* condition pervading the seam here as elsewhere, and from which no extent of excavation is likely to find it exempt, prevents its being of importance as a merchantable article.

Coal of Brushy Mountain, Strouble Run, &c.—The structure just described as prevailing along the eastern slope of Caldwell mountain in the vicinity of the Catawba furnace, is continued with slight modifications in the same direction to the extremity of Brushy mountain in Washington county. At Tom creek and other points where the coal seam has to some extent been explored, the rocks of X forming the eastern slope of Brushy mountain, and occupying the low glades or hollows along its base, are seen diping at a very gentle inclination towards the south and east, generally overlaid by the Valley slate, or formation III. The straightness and uniformity of the fault in this region, and perhaps the absence of the ponderous overtilted masses of IV may explain the fact that although much splintered and glazed by attrition, as in the case of the localities previously described, the seam as here developed is capable of furnishing some fragments of good size, and being at several points where it is exposed little intermixed with slate, bids fair hereafter to become of local importance for domestic and manufacturing uses.

The rocks and coal seams of Strouble run in Price mountain being but an outlying repetition of the same strata in similar circumstances as to structure and composition as those just described, require no more particular mention in this place.

Besides the *real* exposures of coal above noticed, all referible to a single seam appertaining to formation X, and reaching with some interruptions entirely across the state, numerous *imaginary* localities of this material are met with in The Valley and along its western margin. These occur in no one formation exclusively, but anywhere that a black shining slate may be exposed—and as bands of this description are frequent in VIII, and occasionally show themselves in the slates of IX, and even of III and I,—the fancied coal seams are very extensively diffused.

The details above given will, it is hoped, enable the enterprising enquirer to understand in what position and geological circumstances this coal of X occurs, and while guiding him to its discovery at points not yet actually exposed, will repress unfounded expectations regarding its probable improvement in extent and solidity, at new points, or in the course of carrying forward the present explorations at the mines. It may be useful in this connection to repeat what has already been stated more than once in my reports, that *no true coal seam exists anywhere in the formations lower in the series than X*,—and hence, from the sketch of the structure of The Valley, and various synclinal groups of mountains rising above its surface, except in the outlying X of Price mountain, *no such seam is to be found anywhere within that area*. Of the *economical importance* of this determination a due sense will be entertained from considering the numerous fruitless expenditures of money and time it will prevent; expenditures most usually incured by those by whom they can be but illy spared, but whose sanguine credulity in regard to matters of mineral wealth, surviving repeated disappointments, can only be arrested by the positive determinations founded upon systematic observation."

5. From Rogers' Report for 1839.

On page 89 is the following description of Formation No. X:—"Of the various axes hereafter to be described, occuring within the eastern margin of the great area of coal rocks, but one has yet been found south of the Maryland and Pennsylvania lines, and north of the deep gorge-like valley of the Dry fork of Cheat river, in which the formation here refered to has been sufficiently elevated to be brought distinctly into view, while in both of the states just mentioned not only this but formations IX and VIII still lower in the Apalachian series, are developed in considerable extent by the expansion of some of the Virginia axes as they are prolonged towards the northeast. Of the existence of the formation in question, in the middle and southern parts of Randolph county, no opinion can as yet be formed, as our explorations in the northern part of the coal region have not been prolonged to any great distance south of the fork of the Cheat river before mentioned, which traverses the county in a N. W. direction. Along this stream, which flows in a profound transverse trench across several axes hereafter to be described, not only this but two subjacent formations IX and VIII are in part exposed. But minute examinations still further to the southwest have clearly shown that in none of the axes there presented has this formation been elevated to the surface. Indeed, throughout this part of the eastern margin of the coal region, the undulations are extremely gentle though of great breadth, and merely sufficient, where aided by the deep trenching or denudation, here giving the wildest irregularity to the outline of the eastern escarpment of the coal rocks, to bring into view the formation lying immediately beneath (XI), and between them and that of which I am now speaking.

Along the eastern slope of the Alleghany front ridge in the northern part of the state, and its continuation in the lofty range separating Pendleton from Randolph county, the rocks of this formation may be seen generally about midway up the mountain, They here consist of coarse white and redish sandstones, often containing pebbles, greenish and redish micaceous sandstones of a slaby structure, and conglomerates consisting of white pebbles embeded in dark brown or greenish paste. At many points the coarser sandstones, as well as the micaceous fine grained rocks, are rich in impressions of vegetable stems and leaves, usually converted into bituminous coal, and in some places within these limits a very thin seam of impure coal is interposed, though continued only for a short distance.

In Pocahontas and Greenbrier counties this formation thrown a little west of its original direction by the rising of new axes in the Apalachian district, is seen skirting the Greenbrier river to near the bridge a few miles east of Lewisburg, presenting in general the same characters as above described, but including at various points, as for instance on the river west of Huntersville, a conglomerate of remarkable coarseness, in which whitish pebbles, sometimes two inches in diameter, are embeded in a brownish and greenish paste. As followed in this direction, its thickness, though fluctuating, is very much augmented, as will appear from the fact that while on the Potomac below Westernport, where the river makes a transverse section of the Dan mountain or Alleghany front ridge, it measures only about 200 feet across in a direction perpendicular to its lower and upper bounding plains, in the vicinity of Lewisburg its width is about 800 feet. It may also be remarked, that with this increased development of the formation thus locally presented, we find, as has been noticed in numerous other cases in regard to

the same group of rocks, a corresponding development of the thin seam of coal included in it, as occurs in the vicinity of Lewisburg, though here as in most other parts of the formation the amount and quality of the coal are not such as to repay exploration, except for immediate neighborhood purposes, and indeed but rarely even for these. West of the exposures near the Greenbrier river, it is not again brought up, excepting over a narrow space in the low anticlinal hill called Brushy ridge, which separates the Levels from the valley of Sinking creek. It is here flanked on both sides by the overlying limestone of the formation next to be noticed.

Of the character of formation X as presented in several of the axes in the northern part of the state, particular mention will be made in treating of that district under a subsequent head."

On page 104 mention is made of X as forming part of the anticlinical axis between Stony run and Abraham creek of the upper Potomac; and on pages 113 and 114 that it is seen in the basins of Preston and Monongalia counties, W. Va.

In Rogers' Reports for 1840 and 1841—the latter the last of his Va. reports—no mention is made of No. X or its coals.

Want of space forbids further extracts, at this time, from other published writings of Prof. Rogers concerning the coals of No. X, or of stating the particulars of his scathing denunciation of a paper read by a Dr. Salisbury on the "Dora" coal-field, at a meeting of the Am. Association for the Advancement of Science, at Washington, D. C., (in 1852 we think), as false and misleading in its statements; nor for the advice he gave, but a short time before his death, to parties consulting him, who had been pressed to "speculate" in that region.

The Timber Industry of W. Va.—A correspondent, H. C., of the Chicago "Northwestern Lumberman," from Ashland, Ky., under date of June 26, 1883, writes as follows:

For three weeks I have been stoping off at various stations along the line of the Chesapeake and Ohio railway, selecting those points from whence lumber is most generally shiped. I am so delighted with the natural features of the country that I can hardly curb my admiration sufficiently to place my thoughts in words and confine myself to the lumber interests. Before I started on this trip I had studied the map of West Virginia, as recently issued by the United States Census Department, the surveys and calculations having been made by Professor Sargent. From that map I was led to believe that, along the line of the railroads, and also the rivers, the country had been denuded of all the timber for a distance of from three to ten miles on either side. On my way west it was my good fortune to make the acquaintance of Maj. Jed. Hotchkiss, a gentleman well-known in the East, not alone as editor of *The Virginias*, published at Staunton, Va., but as a gentleman well posted on all important interests of West Virginia, and in my brief conversation with him I learned that, from personal observation, based upon personal surveys, after many a weary tramp over rugged mountains and along rough roads, he was willing, yes anxious, to assume the responsibility of asserting the incorrectness of Prof. Sargent's survey, and in places where the latter had, by his map, showed land already cleared of timber, it could be proved that not a tree had yet been felled. The Major is evidently an enthusiast on the resources and wealth of the State; and he has every reason to be such, for a chance traveler cannot fail to behold the wonderful growth of forest, and there are evidences enough of the riches under ground, in the way of coal and ore.

I will now tell your readers something about the timber production I found along the eastern end of this railroad as it enters West Virginia. That is the best place to secure oak, and at almost every station, mills are cuting out bill stuff, most of which is sent to New York and Philadelphia, and thence to British and Spanish ports. It would surprise eastern buyers, especially Boston men, to see the quality of the oak that is shiped on these foreign orders; and it is loaded on the cars right from the saw. I found plenty of ash at various stations, but a large portion of it was badly manufactured. The chief fault was, it was cut too thin. When it should have been plump inch, it was in some cases not over seven-eighths, and proportionately on the other thicknesses. I found more or less walnut all along the line, but, as a rule, it was not such as eastern buyers would want. It was cut mostly from small logs, and by unexperienced mill men. It is, in many instances, most unsaleable lumber. I found that all the good-sized walnut logs are being picked up and sent to eastern ports for export, which, for some time, has been the most profitable way to handle walnut.

Along the western end of the railroad, as it nears the Elk and Big Sandy rivers, the large growth is poplar, and it finds ready sale at Cincinnati and other points along the Ohio river, being shiped thence in barges. It is manufactured into boards and plank, while the small stuff and pieces are, in many instances, cut into bed slats, and laths, and small dimension stock. At several of the stations are mills that are run directly in the interest of Boston parties, or by men who originally came from Massachusetts; and they informed me that most of their cut was shiped to that market, the market and inspection being in every way satisfactory. I made inquiry as regards freight accommodation, and I found the agents of the Chesapeake & Ohio railway a very accommodating set of men, while the general freight agent, Mr. B. S. Fitch, at Richmond, Va., is one of those men with whom it is a pleasure to do business. Rates are made by this road, either all rail, or by rail to Richmond, and thence by sailing vessel to New York, Providence or Boston. Mr. W. S. Upshur has charge of this shiping department, and rates are made to cover both rail and water charges.

The territory between Ashland, Ky., and Lexington, Ky., is in many places heavily wooded, and is slowly being opened up, and fine hardwoods are cut. Mr. B. S. Fitch informed me that his road was soon to commence forwarding lumber by way of rail to Newport News, Va., thence by steamers to New York and Boston. Between the timber and mineral productions, the Chesapeake and Ohio railway will have plenty of freight to carry for years to come, and the unusually beautiful scenery along the line must attract many travelers in search of recreation, and with a desire to view the wonderful and grand works of nature. Such scenery as is to be observed at Hawks Nest and Kanawha Falls is not surpassed even in far-away Switzerland, yet how comparatively few have enjoyed it. A Yankee will stand by his flag and his own home, but he goes clean back on the beautiful and wonderful in his own land, "and sails the ocean blue" to wear himself out and spend his shekels in a foreign country, which repays him by sending back a half thousand paupers, for him to lend a hand to support, and I am very certain West Virginia wants none of this class to stop within her boundaries. What she wants is live, energetic men, of perseverance and capital, to open up her lands and send her minerals and timber where they will be sure to find a ready market; and speaking for my native state, Massachusetts, I firmly believe she will at any time prove herself ready and willing to consume and pay for her share of that production, for Massachusetts men and capital are now well sprinkled throughout the state, and their number is daily increasing, and those who remain at home are in many ways helping to convert into cash that which nature has so bountifully bestowed upon West Virginia.

The Southern Historical Society Papers, published at Richmond, Va., by Rev. J. Wm. Jones, D. D., secretary of the Southern Historical Society, are, beyond question, to be ranked with the most valuable historical periodicals of our day; they are gathering and rendering accessible and permanent, on the printed page, the materials for Southern history from those that have helped to make that history. The August-September, 1883, number of these Papers contains 96 octavo pages, mainly filled with the masterly oration of Major John W. Daniel delivered at the unveiling of Valentine's recumbent statue of General R. E. Lee, at Lexington, Va., June 28th, 1883, with an account of accompanying exercises of that occasion, and illustrated by an engraving of this statue, making it a "Lee number" worthy of the great and good man whose name and fame it helps to perpetuate.—We would advise anyone that has not read Maj. Daniel's oration to send Dr. Jones a half dollar and read it in the attractive form in which it appears in these Papers; and farther, we would advise all that can to send him $3 and become yearly subscribers.

The Forest Map of West Virginia.—Prof. S. P. Sharples sends us the following note of explanation concerning the Forest Map of West Virginia that appeared in our May, 1883, No.

"In my article on the forests of West Virginia I notice that an important statement has been omited. I should have called attention to the fact that these maps do not attempt to give more than general ideas in regard to the forests, and that they must not be read too strictly. The yellow does not represent that the country is absolutely destitute of timber, nor does the green represent unbroken forest. In regard to West Virginia I think it will be a fair statement to make, that, in the yellow portion of the map one half or more of the timber land has been cut over, while in the green portion at least 75 per cent or more of the timber is still standing."

Silver currency is very badly needed in all portions of the South, and we believe of the whole country outside of the great cities. Everywhere there is a clamor for "change," and yet there are prominent journals that continue to decry the coinage of silver.—There is food for reflection in the fact that the U. S. Treasury has now on hand $202,930,340 in gold coin and bullion, and but $117,748,459 in silver dollars and bullion. If there is any superfluity it is on the wrong side for the mono-metalists. The favorite coin has gained the verdict in the contest of use

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Recent Virginia Books.—Ginn & Heath, of Boston, have recently published "Two Shakspere Studies, with some Remarks on Class-Room Study," by Wm. Taylor Thom, M. A., professor of English literature at Hollins Institute, Va.

W. Ellis Jones, of Richmond, Va., has recently published "A Brief Sketch of the Life of Wm. Green, LL. D.", by Philip Slaughter, D. D., to which is added a paper by Mr. Green on "The Genesis of Certain Counties in Virginia from Cities or Towns of the Same Name."

Virginia grown Fruits—peaches, pears, plums, apricots, nectarines and grapes—are as large in size and better in flavor, contends the editor of "The Advance" of Lynchburg, Va., than any grown in in California; and yet great quantities of these fruits from that state are sold in Virginia and other Atlantic states at large prices. We agree with "The Advance" in its statement, from comparative trials, and like it, think that there ought to be a large quantity of these fruits grown in Virginia for market.

Great Kanawha, West Va., Splint Coals in Blast-furnaces.

Paint Creek, W. Va., July 6, 1883.

Editor of *The Virginias:* Dear Sir: I enclose herewith copies of letters which we have on file, that may be of interest to the iron-makers of Virginia. These letters are corroborative in their evidence as to the value of Kanawha splint coal as a blast-furnace fuel; they relate facts that the miners of splint coal in the Great Kanawha region have long been aware of.

The coal refered to in the following letters was from the mines of the Crown Hill Splint Coal Company at Paint Creek, W. Va. It is the same coal that was so favorably reported on by the War Department as noticed in *The Virginias*, in a test with fifty other coals from all sections of the country, in which it ranked second and fourth, as a steam producer.

Messrs. A. C. Davis & Co., of Portsmouth, Ohio, are the agents of this company, and it is owing much to their energy and strong faith in the quality of this coal that it has been so successfully introduced among the blast-furnaces and steel-works at Ironton and Portsmouth, Ohio.

The following are copies of letters refered to:

1st. From E. M. McMillin, general manager of the New York & Ohio Iron & Steel Co., Ironton, Ohio, under date of May 7, 1883.

"In reply to your inquiries I will say that we have successfully used the 'Crown Hill' splint coal in our blast-furnace for some three months. We have varied the proportions with coke, all the way from two-thirds (by weight) down to one-quarter. We have noticed no trouble from sulphur; quality of iron uniformly good, when using a good mixture of ores. We regard it as a first-class furnace coal."

2nd. From H. R. Brown, of the Etna Iron Works, Ironton, Ohio, under date of June 19, 1883:

"We have been using your 'Crown Hill' splint in our Alice furnace for some three months with entire satisfaction. The coal is strong, hard, and free from sulphur. The iron made while using one-half of this coal and one-half of New River coke was a very uniform, soft, foundry iron, and we can cheerfully say to you, that for use in our furnace, we would rather have the 'Crown Hill' splint coal, than any other we have ever tried. It works evenly, carries good burthen, gives strong heat and plenty of gas for hot-blast and boilers."

These results have been a great stimulant to our trade, and have given us a ready market for the entire product of our mines.

Our "Lewiston" coal bed has now a thickness of 4 feet 6 inches, with no slate; the only foreign substance in it is 2 inches of "nigger-head."

Yours truly,
Brewer Smith,
Supt. "Crown Hill" Splint Coal Co.

The Norfolk & Western RR. makes a good showing for the first half of 1883 as compared with 1882, as the following official statement shows:

	1883.	1882.	Increase in 1883.
Gross earnings.	$1,209,435	$1,024,959	$184,475, or 18 per ct
Expenses.....	707,498	620,499	86,999, or 14 "
Net earnings,	$501,936	$404,460	$97,475, or 24.1 "

Note.—The New River division was opened to the Flat-top coal fields May 21st, 1883. The earnings and expenses for the month of June embrace the entire line, including the New River division.

Virginia Iron Furnace Notes.

Victoria furnace of the Iron and Steel Works Association of Virginia (Limited), near Goshen, on the Chesapeake & Ohio Ry., as we noted on page 65 of our May, 1883, No., went into blast the first of last May; on the 15th of the present month we visited this, the largest of American blast furnaces and found it in successful and satisfactory operation, now making about 100 tons a day of one-half No. 1 and one-half No. 2 foundry iron, all from ores obtained from the mines of the company in Brushy ridge, near Rockbridge Alum Springs.

Recently the general manager of the operations of this association found it necessary(for good reasons that need not be mentioned), to discharge the foundryman, and a number of his assistants, that had been in charge of the furnace; this gave rise to rumors and statements in regard to this furnace and its operations that we ascertained had no foundation in facts.

This furnace has had an average output of 2,600 tons per month, or about 87 tons per day, since it went into blast; it has had an average yield of about 47 per cent from the Oriskany (No. VII) ores, that it has hitherto been using exclusively, though it will now use some Clinton (No. V) ores from a new mine that it has opened on its lands in the northeast end of Brushy ridge near the site of old Mt. Hope furnace.—The ores are mined very cheaply, 12 miles southwest from the furnace, and delivered to the furnace by a well constructed narrow-gauge railway. The stock-pile at the furnace now contains over 30,000 tons and the policy of the manager is to keep it so by working a large force at the mines and adding daily as much as the furnace consumes. The iron made at Victoria is now sold mainly in Chicago, Cleveland and Pittsburg.

The limestone used is brought from Bell Valley station of C. & O. Ry., 6 miles northeast of the furnace, where it is cheaply quarried, costing only about 75 cents a ton delivered at the furnace. It is Lower Helderberg (No. VI) limestone, the same that is used at Longdale, Low Moor, and other furnaces in Apalachian Virginia, and is a most excelent flux. The first foundryman used about 35 per cent of limestone, but the present one is using about 52 per cent.

The consumption of coke so far has been about 1.3 tons to the ton of pig iron produced. Owing to the delays in geting the coke ovens at Hawks-Nest in operation a considerable quantity of Connellsville coke has been used, but now two-thirds of the supply is from the Soldenhoff-Coppee ovens at Hawks-Nest, W. Va., on Chesapeake & Ohio Ry., and in a short time the entire supply will be obtained from these W.Va. ovens, the coke from which furnishes, from the experience of this furnace, more heat than does the coke from Connellsville.

Victoria furnace, as now operated, is a stack 84′ by 20′ and 11′ 6″ across the tueyres, 10′ 6″ at the boshes, and 16′ 6″ at the top; it has three 60′ by 25′ Siemens-Cowper-Cochrane stoves. About 600 men are employed by this company. The chairman of the Association is Major D. P. Peploe of London, Eng.; the financial and managing agent is Capt. W. N. Page, Goshen, Va.

We learn that three of the directors, Maj. D. P. Peploe, Mr. T. B. Edwardes and Capt, E. Digby Boycott, from England, will visit this furnace early next month. In common with his many friends in Virginia we regret that Dr. Houghton, also of the directory, will not return to Virginia this year.

Messrs. E. L. Harper & Co., of Cincinnati, Ohio, under date of July 12, 1882, write us: We have been appointed sole sales agents of the "Victoria Furnace," of Goshen Bridge, Va., capacity 55,000 tons per annum.

As we have had a large and highly satisfactory experience in the best brands of Virginia's famous coke irons through several years in the past, we are fortified in our assurances that this new brand, made from the same excelent materials, will prove fully up to the highest standard, and we can recommend it to our customers as a strictly first-class coke iron in every particular. Every pig is broken to secure even grading, so that buyers may feel assured that they will receive the grade ordered.

Tests of Victoria pig-iron.—Under date of Aug. 18, 1883, E. L. Harper & Co. of Cincinnati send us the following tests of Victoria furnace pig-iron made by Swift's Iron & Steel Works:

First.—Of No. 2 mill iron puddled and put through squeezers as common iron is generally worked. Muck bar rolled to ¾ inch round, then bent cold double without fracture, then nicked and broken cold, showing a fine silken fibre; ¾ round rolled to ½ inch shows tensile strength 56,000 lbs.

Second.—Samples of ½ gray and ½ white iron puddled and put through squeezers as common iron is generally worked. Muck bar rolled to ¾ inch round then bent cold double without fracture, then nicked and broken cold, showing a fine silken fibre; ¾ round rolled to ½ inch shows tensile strength 58,000 lbs.

Third.—All white iron puddled and put through squeezers as common iron is generally worked. Muck bar rolled to ¾ inch round then bent cold double without fracture, then nicked and broken cold, showing a fine silken fibre; ¾ round rolled to ½ inch, shows tensile strength 60,000 lbs.

Riverside Mill reports test of all white iron by itself the best they have ever used. It melts like lead in the puddling furnace and makes a soft tough bar. Think it will flange, which they will test and report.

Crozer furnace, of the Crozer Steel & Iron Co., located at Roanoke, Va., that made its first cast at 10 a. m., May 30, '83, made about 5,350 tons, of 2240 lbs., of pig in the 74 days previous to and including Aug. 11, 1883. This was an average of over 72 tons a day; excelent results for the initial work of a new furnace, demonstrating the wisdom of its construction. The yield is now from 80 to 90 tons a day, sometimes reaching over 100 tons, near one-third foundry and two-thirds gray forge. The pig made is marketed in the Cumberland valley and at Harrisburg, Pa., in Baltimore, and to nail mills on the Ohio river. Its quality is very satisfactory.

The ores used were mainly from the Upland mines of the Co., near Blue Ridge station of Norfolk & Western RR., 10 miles from the furnace, and from the Houston mines of the Co., near Houston station of Shenandoah Valley RR., 15 miles from the furnace. These limonite ores, from the ferriferous shales of the Potsdam formation, yielded from 40 to 46 per cent, averaging over 44, in the operations of the furnace.—Some limonite ores of the same kind were obtained from the Vesuvius mines, on S. V. RR., in Rockbridge county, and some specular ores from a lower member of the Potsdam at the Upland mines. We learn that this Co. is now using some ore from the mines of the Rorer Iron Co., near Roanoke.

The limestone used is dolomite from quarries near Blue Ridge station of N. & W. RR., and near the furnace, and a very pure limestone from quarries on S. V. RR., near Buchanan —By the looks of things around the furnace we conclude that the founder believes in the efficacy of an abundance of limestone; more than the usual Virginia practice has been in the habit of using with the superior neutral ores of the Western Blue Ridge.

Owing to the delay in geting the coke ovens at Pocahontas, in the Flat-top coal region of the Virginias, on N.

& W. RR., in operation, this furnace began with Connellsville, Pa., coke; but now the supply enables it to use about two-thirds of Flat-top and one-third of Connellsville, and it will soon use Flat-top exclusively. The founder says he does not see but that the results are as good from the one as from the other.—The consumption has averaged about 1.4 tons to the ton of iron made.

The principal office of the Crozer Steel and Iron Co. is at Upland, Pa., not far from Philadelphia, where most of the stockholders reside. Its officers are: Samuel A. Crozer president, W. H. H. Robinson treasurer, Francis E. Weston secretary, and D. F. Houston, who resides at the furnace, general manager.

Callie furnace, near Clifton Forge, Va., and on line of Chesapeake & Ohio Ry., belonging to Messrs. Hileman, Waring & Co., went out of blast July 20th, 1883, on account of an accident that interrupted its railway communications. It will go in again in Oct.

During the blast that ended July 20 this furnace made 1,592 tons (2240 lbs.) of pig iron at a cost of $13.08 per ton. In making this iron the furnace consumed 3,641 pounds of New River, W. Va., coke, 6,063 pounds of No. VII limonite ore and 4,281 pounds of No. VI limestone, from its mines and quarries in the immediate vicinity of the furnace, per ton of iron made. The average cost of the ore and limestone delivered in the stock-house, was 53 cents per ton.—This Co. has on hand at this date 1,529 tons of pig iron.

Low Moor Furnace of the Low Moor Iron Co. of Va., went into its second blast Sept. 23rd, 1882; from that date to Jan. 1st, 1883, it made 8,117 tons of pig iron; and from Jan. 1st to July 31st, 1883, it made 23,218 tons,—making an output of 32,035 tons in the 312 days, from Sept. 23rd, 1882 to July 31st, 1883, or an average of 102.7 tons for each day of the blast to date named.—This first built of the large blast-furnaces of Virginia, is now working in a most satisfactory manner, turning out daily from 115 to 120 tons of high grade pig iron, about half of it No. 1 and half No. 2.

The Rorer Iron Co., one of those that recently began operations in Virginia, has, up to this time, shiped about 2,500 tons of high grade limonite ores, from its mines near Roanoke, Va., to the furnaces at Ironton, Ohio, Quinnimont, W. Va., and Roanoke, Va. The furnace men at Ironton speak in very high terms of the superior quality of the iron they make when using these ores; a quality that fully warrants the cost of these ores after the long transportation from Roanoke to the Ohio.—At this time, Aug. 18, this company is mining from 75 to 100 tons of ore a day and shiping 150 tons every other day. Arrangements are being made, by the introduction of machinery, to wash the fine ore of these mines.

Manganese.—At the Crimora, Va., manganese mines, on line of Shenandoah Valley RR., Augusta county, Va., J. B. White & Co. are sinking a new shaft on the "Wagner" land, about 30′ from the shaft that was sunk five years ago, from which, at a depth of 26′, several hundred tons of good ore were taken.

From the Houston mines, on line of S. V. RR., Botetourt county, Va., they have been shiping about 30 tons of manganiferous iron ore a day to the Cambria Iron Co., Johnstown, Pa., for use in the manufacture of steel.

One of the owners of the Kennedy iron lands, on westward slope of Western Blue Ridge, Augusta county, Va., near the line of Shenandoah Valley RR., informs us that in the prospecting operations now going on the miners have cut a bed of manganese ore.

Foreign Iron Ores are now being sent to this country in large quantities, destroying the market for our own native ores and puting a stop to the development of our iron mines.

The Manufactures' Record, of Baltimore, of a late date, states that 25 steamships are to arrive at that port before next September, with 45,000 tons of Mediterranean ores and that the total quantity of foreign ores to arrive prior to that date will be fully 90,000 tons. From Jan. 1st to July 1st, of this year, over 93,000 tons of imported iron ore have reached that city, against 50,000 in the same period of 1882. To move the 90,000 to 100,000 tons to arrive in the next 60 days will require some 10,000 cars. Freights from Mediterranean ports are now very low. The most of this imported ore goes to the steel mills of Pennsylvania, coming into direct competition with ore from the South and bringing down prices below a living rate in this country. And yet we have papers advocating the development of our mines and at the same time advocating free trade!

Iron market report.—Under date of August 20, 1883, E. L. Harper & Co. of Cincinnati report to *The Virginias* as follows:

There is no material change in the market since our last report. Buyers are gradually coming into the market with fair sized orders, and prices are well sustained. Strong number one coke foundry and best number one silver grey irons continue very scarce. The mills continue active with a good share of orders on hand at fair prices. We quote as follows, 4 mos time: Charcoal foundry $22.75–$24.75; strong neutral coke foundry $18–$20.50; gray forge neutral coke $17–$17.50, and cold-short $16.50–$17.; Southern car-wheel strictly cold-blast, $28–$29.

Flat-top Coke.—We learn from superintendent W. A. Lathrop, that the Southwest Va. Improvement Co. is now making a satisfactory coke, from Flat-top coal, in its fine ovens at Pocahontas, on Norfolk & Western RR., as we knew it would as soon as its operatives learned how to manage New River coal. As we have stated elsewhere, the Crozer furnace people now find this coke perfectly satisfactory and can see no difference between it and Connellsville in blast-furnace use.—We have had samples of this coke sent to Prof. Dewey and Dr. Froehling for tests and analysis, which we hope to give in our next

Of No. X Coal in Laurel Hill, W. Va., Prof. W. B. Rogers says, in a report on the Pridevale iron property on Cheat river in 1854: "Here, about midway between the opposite flanks of the range, are seen the peculiar sandstones and slates of a formation geologically far below the true coal measures, but which sometimes include a thin and delusive coal seam."

The Sewell coal bed, of the Longdale Iron Co., at Sewell station of Ches. & Ohio Ry., is 949′ above the railway which is there 1000′ above tide level. This is a 4′ seam of fine coking coal. The uper seam at these mines is 2,222′ above tide. We are indebted to superintendent John A. McGuffin for these facts.

The Coke-burning locomotive of the Reading Ry. proves that continuous runs of 200 miles can be made with coke fuel without any farther attention than simply feeding the furnace. Its success is complete; and it demonstrates that all railways should use coke exclusively on their passenger trains.

Spelter should be cast in round ingots 3 or 4 inches in diameter, contends J. B. Sharp of Brimingham, Eng., as that form is more convenient for remelting without loss, etc.

The Position of the American Iron Trade.

"The close intimacy which exists between the condition of the iron trade in America and that of the sister industry in this country is too well known to our readers to require demonstration at the present time. When the first of the great burst of enterprise in railway building began to manifest itself in the autumn of 1879, and prosperous times commenced to dawn for the iron and steel manufacturers of the United States, it was not long before the ironmasters of Great Britain experienced an alteration in the disastrous state of trade which they had to contend with during the preceding years. Since the first signs of reaction on the other side of the Atlantic have been visible, the iron trade here has been in a depressed condition; and now, in both countries, reductions of wages, difficulties with the workmen, and strikes and lock-outs are occuring. If, however, we omit the difficulties in the tinplate trade of South Wales in December last, there has been no stopage recently of any important company connected with the iron trade of this country; while, on the other hand, there has been more than one disaster in the iron industry of the States within the past few months. The movements in America have been more rapid and extreme than they have been here, and while English ironmasters did not enjoy such a degree of prosperity as was the lot of their American brethren during the years 1879–82, neither have they yet to complain of such bad times as from all accounts have befallen the latter. The reason of this is doubtless that the market which the ironmakers of the States command is virtually confined to their own country. We say virtually, because the United States are not without an export trade in iron, yet it is so small as to be of no account in comparison with the capabilities of the works and the volume of home consumption. When the country enters upon a period of prosperity, the whole energies of the works are taxed to supply the demand for iron; but when the "boom" subsides, there is no other outlet for their manufactures to which makers can turn to find compensation for the falling-off in the home consumption. With this country it is different; the whole world is open to our manufacturers, except where hostile tariffs have raised artificial barriers against their products, and, when the wants of one country are satisfied for the time being, they have a dozen other channels through which to dispose of their production.

The question will probably be asked whether the present depression in the American iron trade may not prove to be only a transient check. We are afraid, however, that it will be some time at least before things mend greatly over there. The "boom" was coincident with the marvelous activity which for three years prevailed in railway building, and as that has slackened, so has the prosperity of the iron manufacturers vanished. The mileage of new railways built in the States this year so far is much under last year's rate, and there is no appearance at present of any further rapid extension of the railway system of the country being undertaken. The achievements of the last three years have locked up a vast amount of capital in a form which in very many cases is quite unproductive just now, and may remain so for some time to come. The extension of the railway system in the Western States has outstriped the development of the country. It is necessary that a pause should be made to enable the country to catch up and to get in advance of the railways; and when that has been done, we may see a repetition of what has happened within the last three years. It must be remembered also that the growth of the iron trade of the United States has made rapid strides in the interval, and it may be questioned whether under the influence of the enormous demand experienced during the years 1879–82 the powers of production have not been forced to a pitch far beyond the ordinary capabilities of the country to consume, notwithstanding the continual development of them which is taking place through the rapid increase of population. Another consideration which should not be forgoten is that, when speaking of the United States, we are talking about a country which is a continent in itself in the same manner as if it were of the size of Great Britain, or France, or Germany. It is clear, however, that the development of the iron industries of such a country must be a very different matter, and must be surrounded by circumstances greatly varied from those to which we are accustomed in this country. For instance, here the change occasioned by the migration of trade would perhaps only effect a small and, comparatively speaking, unimportant section of the industry; but a smilar movement in America would embrace the whole of the industries of a territory as large as England, and might paralyse for the time pretty well all the iron trade of the country.

From accounts which reach us, such a movement as has just been indicated is impending at the moment in the United States. From one cause and another the manufacture of pig-iron in certain parts of Pennsylvania now costs more than the product will sell for. In Middle Pennsylvania it is stated that the cost of making a ton of pig-iron is from $18 to $19.50; in Western Pennsylvania the cost is $17 to $18; and in some parts of the eastern portion of the same state it rises to as much as $20. But the price it fetches in the open market is under $17 per ton. While the supply of coal is abundant, iron ore is found only at a few of the points where the works are situate, and a large proportion of the ore used is brought from Lake Superior, or else imported. But with the opening up of the country by the development of the railway system, the concentration of the iron manufacture within a limited area is becoming less and less possible, and at the same time the markets are being brought within reach of the regions from which they have hitherto been inaccessible. The slackening of the demand for iron in the States tends to ripen the time for such a change as is looming in the near future. When the change does come, the migration will, as appearances point at present, be made in the direction of the south-west regions of Virginia. There, it is asserted coal and iron ore abound in such favorable juxtaposition as will enable pig-iron to be manufactured for a very much less cost than in Pennsylvania. Even with the drawback of having to bring coal and coke from the latter state, iron can at present be made in Virginia at a cost of from $11 to $13 per ton; but it will not be very long before Virginia is able to supply a sufficiency of excellent fuel from within its own borders.

Bearing all these considerations in mind, a statement as to the condition of the furnaces of the United States which has been drawn up by the "Bulletin" of the American Iron and Steel Association has particular significance. From this statement it would appear that between January 1 and June 1 of this year no less than sixty-six furnaces were blown out, and there were twenty-seven more which were to be blown out shortly. This statement shows that, while some of the rumors which have been in circulation were extravagant, the situation is quite bad enough. According to the reports received by the 'Bulletin' from its correspondents, in some instances charcoal furnaces were kept runing merely in order to use up the stock of fuel, but no fresh wood was being cut; while, on the other hand, a more cheerful view of the position was taken by some persons who believed that stocks were being allowed to run too low, and that sooner or later consumers would awake and find themselves confronted with a scarcity of pig-iron. However that may be, we have the fact to deal with that, out of 688 furnaces completed within the United States on June 1, only 351 were in blast,

or little more than 50 per cent; while on January 1 over 60 per cent of the furnaces then built were in operation. So far as Pennsylvania itself is concerned, although the proportion of furnaces in blast on June 1 is larger than for the whole of the United States, yet the decline in the number since the begining of the year is almost the same as for the entire country. The following table will preserve for future reference the exact figures so far as the whole of the States is concerned:—

	In Blast.		Out of Blast.		Total Furnaces.	
Fuel used,	Jan. 1	June 1	Jan. 1	June 1	Jan. 1	June 1.
Anthracite	161	137	64	86	225	223
Bituminous	127	109	83	105	210	214
Charcoal	129	105	123	146	252	251
Total	417	351	270	337	687	688

Editorial in "Iron" of London, Eng., of Aug. 3, 1883.

Personals.

Prof. I. C. White of W. Va. University has been engaged for some time in making explorations and giving advice in reference to sinking natural gas-wells near Pittsburg, Pa.; he has now resumed his work on the 2nd Geol. Survey of Pa., with headquarters at Huntingdon.

Mr. Richard H. Sanders of Philadelphia, one of the geological corps of the 2nd Geol. survey of Pa., has recently spent some time on the coal lands of the Bluestone-Flat top Coal Co., Mercer county, W. Va., for the purpose of reporting on them for a syndic of Philadelphia, Pa., and London, Eng., gentlemen proposing to purchase the great coal property—some 50,000 acres—belonging to that company. Capt. I. A. Welch showed him these lands and the coal beds that he had proved on them. We understand that the examination was everyway satisfactory, fully confirming previous reports. Mr. Sanders has prepared and sent in a full report of his explorations.

The Ohio Central RR. has been an object of much interest to us ever since it entered West Virginia, by constructing a railway up the Great Kanawha river from its mouth to Charleston and engaging in the building of a steel bridge across the Ohio at Kanawha-mouth, promising by these movements and the extension of its lines into that state (and even into Virginia) to become a very important factor in its development, especially in giving direct access to the northwest, to the great cities of the Lakes, for our coals, cokes, and lumber of unsurpassed excelence.

We see, by our exchanges, that this railway has now a regular daily passenger, mail, and express service between Charleston and Point Pleasant, leaving the former at 7 a. m. (Columbus time, 25″ slower than Washington) and reaching the latter at 11 a. m.; then leaving Point Pleasant at 3:30 p m., and reaching Charleston at 6:30 p. m.; except on Sunday when the train leaves Charleston at 8 a. m. and Point Pleasant 5 p. m. It charges but a single fare for the round trip from Charleston to Point Pleaaant if made the same day.—Mr. J. A. Jeffards is the Charleston, W. Va., agent of this railway.

The steel railway bridge of this Co. across the Ohio is approaching completion, and it is reported that about this time the trains of that road in Ohio will run to the western end of this bridge, connecting it with the thriving city of Toledo on Lake Erie.

The most interesting current item concerning the Ohio Central remains to be told. We see in a Charleston paper a notice to its stockholders to meet on the 12th of Sept. to act upon a lease that has been made to the Chesapeake & Ohio Railway of the bridge across the Ohio at Point Pleasant and of the portion of the railway of this Co. between Point Pleasant and Charleston. This is the outcome of the following statement in President C. P. Huntington's annual report for 1883:—"The Ohio Central Railroad Company have extended their lines to the Ohio river, opposite the mouth of the Kanawha, and have constructed a branch from the mouth of the Kanawha to Charleston, W. Va., where connection can be readily made with our road. They are building a bridge across the Ohio river to connect their line in Ohio with their Charleston branch. It is believed that a traffic agreement may be entered into between the two companies which will prove mutually advantageous."

This lease, which of course will be ratified, is a matter of great importance to the Chesapeake & Ohio and to the Virginias. It means a speedy completion of the Kanawha valley road from Charleston up to at or near Kanawha Falls, where the Kanawha can be cheaply and quickly bridged to the line of the Chesapeake & Ohio, thus giving that railway easy and direct communication with Cleveland, Toledo, Chicago, Cincinnati, St. Louis, and all the great northwest, without the lengthy detour and troublesome transfers of its present connections for the cities named by way of Ashland and Winchester, Ky. It will give it, within a year if it so wills, a clear and solid track by the most direct routes possible from Newport News, from the finest commercial harbor on the Atlantic border of the United States, to all the great business centres of the West. For these states, especially for West Virginia, it will open the way to many of the very best of markets for its superior coals and cokes, creating a constant demand for these fuels that will speedily enhance the value of its coal lands and quadruple its production of coal in a very short time.—Among the many grand movements of the Chesapeake & Ohio to make it the great transcontinental railway of the United States, none of more importance has been made than the one now about to be consummated.

Coal and Grain at Newport News.—A correspondent of the New York "Commercial Bulletin" writes, under recent date, that from statistics it is found that the coal business takes the lead. In this respect the Chesapeake & Ohio successfully competes with the Pennsylvania and Baltimore & Ohio roads. The West Virginia mines, none of which are under water level, produce a coal excelent for steam-making, and much sought after by the steamers entering this port. No less than 30,000 tons a month have been shiped from here since 1st June of last year. Up to this month 365 steamers and about 280 schooners and other craft have coaled at the company's docks, steamers taking from 500 to 700 tons, on an average, for their own consumption; the schooners carrying it as cargo to Boston, Providence and New York.

When asked why they can export coal, the company informed me that as no pit shafts were required, and as labor in West Virginia was cheaper, Boston, New York and other places could not get it at such a profitable rate. Grain was loaded for the first time here in July, 1882, the vessel going to Cork for orders. One also sailed for Trieste about the same time time. The steamer "Roland" carried as much as 80,000 bushels, sent to Europe from Peoria, Ill. In July and August, 1882, no less than 900,000 bushels were exported from here to Europe, the business becoming so heavy that it seriously menaced the company's other trade, and, pending the building of the huge elevator here, had to be partially abandoned, the facilities for handling such large quantities being inadequate

Richmond, Va., says "The Dispatch," has 675 manufacturing establishments employing a capital of over $11,300,000. These in 1881 made sales of products to near $34,000,000.

Notes on the Geology of West Virginia.

Written for *The Virginias* by Prof. I. C. White.

[Continued from page 110.]

No. V. Geology of the Ohio river from the mouth of Pipe creek to Martinsville

Just below the locality of Sec. 4, (the mouth of Pipe creek) the Ohio river veers abruptly around to the south, turning through an arc of 100°, and flows even 10°-15° east of south for about four miles. As a result the rocks pitch rapidly under the river, and carry the Pittsburg coal farther and farther from the surface, which it had so closely approached at the elbow in the river near Pipe creek.

Hog run puts into the Ohio from the W. Va. side about one-half mile above the mouth of Captina creek, and four miles and a half below Pipe creek. The hills rise almost vertically from the river just above the mouth of Hog run, and expose the following section (5) in descending from their tops:

No. XVI, or Permian Beds.

1.	Concealed from hill top	75′
2.	*Red shale*	10′
3.	Concealed	15′
4.	Sandstone, massive	15′
5.	Concealed and shales	25′
6.	Limestone, interstratified with shales	20′
7.	Sandy shales and flagy sandstone	25′
8.	*Coal blossom*, Washington	5′
9.	Concealed flaggy sandstone and shales	75′
10.	Massive sandstone, Waynesburg	20′

285′

No. XV, or Uper Coal Measures.

11.	Concealed, flagy sandstone and sandy shales	70′
12.	Sandstone, flagy	8′
13.	Shales with some *red* below centre	10
14.	Limestone	10′
15.	Concealed	80′
16.	*Coal*, Sewickley	4′
17.	Concealed to low water in Ohio river	15′
18.	Probable depth to *Pittsburg coal*	55′

252′

Total 537′

As will be observed from this section, the *Pittsburg coal* underlies the bed of the Ohio at the mouth of Hog run at a depth somewhere between 50 and 60 feet, since No 8 is unquestionably the coal that we have identified with the Washington, and which in the previous section (4) at Pipe creek, and the one in Chapline hill (2) Wheeling, is found at an elevation of 360 feet above the Pittsburg bed. Above this same coal (Washington) at a height of 95′-100′ is also found a bed of *red shale* which being the first one of any prominence makes quite a conspicuous landmark in the sections at Grave creek and Pipe creek. It occurs here in the Hog run section at 100′ above No. 8, and of course proves that bed to be the Washington coal.

The *Waynesburg coal* was not seen at this locality, since it is very probably concealed near the top of No. 11.

No. 10 seems to represent the *Waynesburg sandstone* which is here very massive and crops out in a bold cliff along the hills for several miles below this point.

Captina creek puts into the river from the Ohio side a short distance below the mouth of Hog run, and as its course is toward the south-east, the Pittsburg coal soon rises above its bed in passing from the mouth of that stream northwestward up the same. Along Captina creek this coal has long been mined in southern Belmont county, Ohio, for local supply, and is a very valuable bed, averaging 5′-6′ of good merchantable coal.

From the mouth of Captina creek, the course of the Ohio river is about S. 15° W, to Clarington, Monroe county, O., at the mouth of Sunfish creek, 16 miles below Moundsville or 28 from Wheeling. In this direction the rocks continue diping gently below the Ohio as we pass southward from Captina creek, so that when the mouth of Sunfish creek, or Clarington is reached the horizon of the *Pittsburg coal* has passed far below water level, as the following section (6) taken in descending the steep river bluff just above Clarington, will show:

1.	Concealed from top of knob near Mrs. Gotthart's	20′
2.	Sandstone, rather massive, brown	8′
3.	Concealed	22′
4.	*Red shale*	5′
5.	Concealed, with 2′ of sandstone at base	10′
6.	*Red shale*	10′
7.	Sandstone, massive, grayish brown	15′
8.	*Red shale*, containing iron ore nodules	5′
9.	Brown, sandy shales and shaly sandstone	25′
10.	*Red shale*, marly, with limestone nodules in centre	15′
11.	Sandstone, massive, makes cliff	20′
12.	Concealed	25′
13.	*Red shale*, with limestone nodules near centre	10′
14.	Yellowish, sandy shale	5′
15.	Sandstone, massive and flagy	10′
16.	Shaly sandstone, sandy shales and concealed	35′
17.	*Coal*, reported	3′
18.	Concealed and sandy shales	30′
19.	Sandstone, quite massive	35′
20.	*Coal*, (Washington ?) reported	3′
21.	Sandy shales and concealed	25′
22.	Sandstone, rather massive	8′
23.	Concealed, and sandy shales	25′
24.	Concealed	40′
25.	*Coal*, slaty at top (Waynesburg ?)	4′
26.	Concealed to low water in Ohio river	75′

Total 488′

This section has given me some trouble, since no intermediate ones were taken (owing to night coming on) between Clarington and Captina creek, 7 miles above. At first I was inclined to identify No. 17 with the *Washington coal* of the previous Ohio river sections, but then it seemed improbable that the interval between it and the next lower coal should have decreased more than 50′ within 7 miles, and then, the interval from it up to the first *red bed* is only half that found in the former and other sections. Then, to increase the doubt, the interval between coals 20 and 25 is nearly 100′, or the same as that found separating the *Washington* and *Waynesburg beds* at Wheeling, Moundsville and Pipe creek (Secs. 2, 3, and 4). Added to this is the fact that a shaft begining 25′ below No. 25 was sunk to a depth of 190′, just above Clarington, but found no *Pittsburg coal.* Hence, taking all the facts into consideration, it seems the most reasonable to identify coal No. 25 with the bed (Waynesburg) which at Wheeling, Grave creek and Pipe creek comes 240′-250′ above the Pittsburg bed, and is there, as here, 4′ thick, and somewhat slaty. This determination would place the horizon of the *Pittsburg coal* 165′-175′ below the level of the Ohio river at Clarington.

The attempted shaft to the Pittsburg coal at Clarington was begun in 1877, by Mr. Wm. Bailey, with the expectation of finding the coal at about 100′ from the top of the shaft.—But not finding the coal at the expected depth, Mr. Bailey kept on going deeper until all his funds and credit were exhausted, living upon the scantiest fare in order to economize his resources; but the unlooked for depth was against him, and he was compelled to desist, for lack of means, at a depth

of 190', only 25'-30' above the horizon of the coal, according to my identifications. The cost of the shaft was about $25,000, and it is now partly refilled with rubbish, but could be cleaned out and finished to the coal at a cost of $2,000-$3,000. Before this expenditure is incured, however, a hole should first be drilled to be certain that the coal is not absent, since the *Pittsburg coal* disappears farther down the Ohio river, and may be missing at Clarington. This would certainly be true if I have made a mistake in identifying No. 25 with the *Waynesburg coal*, or if, in other words, No. 20 of the section is the coal that belongs 240'-250' above the Pittsburg bed, for then the shaft has already penetrated 60'-70' below the horizon of the *Pittsburg coal*. For the reasons given, nevertheless, I have much confidence that the conclusion placing the *Pittsburg coal* at 165'-175' below the coal of the Ohio at Clarington is the correct one, and this is strengthened from the report given me that the shaft stopped in limestone which had been the prevailing rock for many feet. Since there are no limestones in the *Barrens* under the Pittsburg coal, it would seem certain the horizon of the latter bed had not been passed at the bottom of the shaft.

Only one bed of coal (Sewickley) 12"-15" thick, is reported as passed through.

The Waynesburg coal, No. 25, is not now mined, though a few years ago several thousand bushels were taken from a bank within the village limits, and sold for local supply. It is somewhat slaty, however, and could not compete with the purer coals shiped from Pittsburg and other points.

The openings in Nos. 20 and 17 had both fallen shut, so that neither of these beds could be seen; the coals are reported, however, to have a thickness of about 3' each, including parting slates. Also No. 20 is said to be remarkably pure and free from sulphur, being especially prized by the smiths who formerly carried it down over the steep cliffs in baskets when they wished to do extra fine work.

Just above the mouth of Sunfish creek, and on the west bank of that stream, just below Clarington, the following section (7) was obtained in descending a steep hill:

1. *Red shale* with limestone nodules near centre.....10'
2. Concealed and sandy shales.....60'
3. Concealed and massive sandstone.....40'
4. *Coal* blossom, Washington.....5'
5. Sandy shale and flagy sandstone.....40'
6. Bituminous slate, fissile.....2'
7. Flagy sandstone and sandy shales.....60'
8. *Coal, Waynesburg*
   - slaty coal.....0' 6"
   - coal, good.....2' 0"
   - slaty coal and shale.....0' 8"
   - coal.....0' 4"

   3'6"
9. Yellowish brown sandy shales.....17'
10. Dark blue shale, blackish at base.....5'
11. Sandy shales.....5'
12. Limestone, gray.....3'
13. Concealed to low water in Ohio river at mouth of Sunfish creek.....40'

No. 8 of this section is identical with No. 25 of the previous one above Clarington, and No. 4 is identical with No. 20 of the same. No. 17 of the Clarington section (6) was not seen in this one, its horizon being concealed in No. 2. It is a coal, however, that has made its appearance in the section between Pipe creek and Clarington, at about the right distance above the Washington bed for "Washington (a)" coal of Stevenson, in Greene and Washington counties, Pa., though, of course, there is a possibility of its being identical with the *Washington bed*, the interval between it and the *Waynesburg coal* having thickened by 50' between Pipe creek and Clarington. Its position here would come about 425' above the Pittsburg bed.

Proctor creek puts into the Ohio from West Va., just south from the Marshall-Wetzel county line, and about 5 miles south from Clarington. The following section (8) was constructed in descending from the summit of a high knob to the Ohio river at the mouth of Proctor creek:

1. Concealed, from top of knob.....25'
2. *Red shale*.....5'
3. Sandstone and concealed.....25'
4. *Red shale*.....5'
5. Concealed.....90'
6. Red shale containing layer of good limestone at least 1' thick.....10'
7. Concealed.....70'
8. Flagy sandstone, and concealed.....35'
9. Very massive sandstone, yellowish gray, rather micaceous (*Uper Proctor*).....30'
10. Concealed.....5'
11. *Deep red shale*.....10'
12. Sandstone, and sandy shales weathering redish.....50'
13. Concealed.....50'
14. *Coal, Washington.*
    - coaly shale.....4'
    - coal, rather pure.....4'

    8'
15. Concealed.....25'
16. Sandstone, rather massive.....15'
17. Concealed.....10'
18. *Coal blossom*, thin.....
19. Concealed.....10'
20. Sandstone, massive, (*Lower Proctor*).....10'
21. Sandy shales.....15'
22. Limestone, hard, bluish gray.....2'
23. Shales, gray and blue.....13'
24. *Coal*, impure.....0'6"
25. Concealed, with a coal near base reported 3' thick.....30'
26. Massive sandstone.....15'
27. Sandy shale, bluish.....10'
28. Blue and *red shales*.....5'
29. Limestone interstratified with shales.....15'
30. Concealed to level of Ohio river, low water at the mouth of Proctor creek.....25'

The coal reported 3' thick near the base of No. 25 must represent the *Washington bed*, or the one that was mined 75' above the river level at Clarington, since No. 29 in the limestone series was seen at Clarington, begining 25' below that coal. On this basis the depth of the Pittsburg coal below low water in the Ohio at the mouth of Proctor creek would be about 175', or almost exactly the same depth as at Clarington, thus showing that the rocks are horizontal between the two points in a north and south line.

The coal No. 14 is possibly the *Washington bed* with the interval between it and the Waynesburg, near the base of No. 23, thickened up to 125' instead of 100' as at Wheeling, Grave creek, and elsewhere along the Ohio river. The bed (No. 14) has been opened at this locality and the lower half is said to be quite good, but the uper portion is slaty and worthless.

Coals 18 and 24 are mere streaks, and seem to come at the horizon of the Waynesburg "A" and "B" coals of Stevenson.

From this locality I have named Nos. 9 and 20, respectively, the *Uper* and *Lower Proctor sandstones*, since the beds in question were found to be quite persistent along the Ohio river below the mouth of Proctor creek for a long distance, making prominent cliff in the river bluffs and proving conspicuous features in the general topography.

A third massive sandstone is often found nearly midway between the two sandstones above designated, and there it has been termed the *Middle Proctor sandstone.*

The Uper Proctor bed, No. 9, is the most persistent and massive one of the three sandstones, and seems to occur at such widely distant points as to well merit a distinct name. It makes the great cliffs at "Walker Rocks," above the celebrated McGugan gas well in Washington county, Pa., as well as many other isolated "Rock cities" in Hickory and other townships of that county. It is the great cliff rock along the Little Kanawha river in the vicinity of Elizabeth and for many miles below, from which the principal supply of building stone is obtained on that stream. And from Elizabeth, in Wirt county, I have followed it both north-east, and south-west, for nearly 100 miles, to the Great Kanawha on the one hand, and the Pennsylvania line on the other, its bold, projecting cliffs and broad "benches" rendering its tracing from hill to hill quite easy, and proving at the same time a most valuable guide or key rock to the geologist.—It has largely affected the topography of all the counties in West Va. in which the Permo-Carboniferous beds are well developed, by its power to resist erosion, having given rise to a majority of those narrow, "hog-back" ridges so frequently found in Wetzel, Tyler, Ritchie, Wirt, Roane, Jackson, and other counties of West Virginia adjoining these. Its economical importance is also very great, since it is nearly always an excelent building stone, dressing easily, and resisting atmospheric decay much better than any other Permian sandstones, which, as a rule, disintegrate with marked rapidity before the combined attacks of heat, frost, and the chemical agencies in the atmosphere. The rock is rather coarse in grain, slightly feldspathic, of a yellowish-brown, or gray color, and usually contains many scales of mica.

About two miles below the mouth of Proctor creek, the following section (9) was taken in descending a steep hill on the Ohio side of the river:

1. Very massive sandstone, *Uper Proctor*.....35′
2. Concealed.....20′
3. *Red shale* with limestone nodules in middle.....10′
4. Sandstone.....10′
5. Concealed and sandy shales.....65′
6. Sandstone, massive.....15′
7. Shales and concealed.....10′
8. *Coal. Washington* { coal, impure, slaty.....2′ / shale, dark, hard.....0 1″ / coal, very pure.....1′11″ } 4′
9. Flagy sandstone and concealed.....60′
10. Massive sandstone, *Lower Proctor*.....40′
11. Limestone, light gray.....5′
11. *Coal*, reported.....2′
12. Concealed and shales with some impure limestone.....50′
13. Concealed to low water in Ohio river.....50′

The Uper Proctor sandstone makes a bold escarpment along the Ohio hills at this locality, and the talus from its cliffs is scattered over the slopes below.

The Washington coal, No. 8, has been opened and mined to a small extent by J. W. Litman, from whom the structure noted above was obtained by student Johnson. The lower portion of this coal is reported by Mr. Litman as almost perfectly pure, and free from sulphur, bringing 2 cents per bushel more for smithing purposes than any other coal in the river market. This agrees quite well with the character of the *Washington coal* in Marion and Monongalia counties where the lower bench of this bed is remarkably pure, but the uper is always slaty and worthless.

The Lower Proctor sandstone, No. 10, has here assumed quite massive proportions, and juts out of the hill in a great cliff which weathers so easily that the rock is honey-combed with cavities.

The Limestone No. 11, is light gray, rather pure and identical with the 2′ bed, No. 22, of the previous section.

A coal, slaty and otherwise impure, is reported directly beneath the limestone.

The Pittsburg coal, if present, would come about the same depth below the Ohio at this point as at Clarington, and Proctor, viz: 175—200 feet.

Fishing creek puts into the Ohio from the West Va. side at the town of New Martinsville, 5 miles below the locality of the last section, and 40 miles below Wheeling by the river channel meanderings.

About one mile up this stream, and the same distance southeast from New Martinsville, a steep and rugged hill rises abruptly from the right bank of the creek to an elevation of nearly 600′ above the same, and in descending from the summit of this lofty knob the following interesting section (10) was obtained:

1. Red shale on top of knob.....5′
2. Concealed.....45′
3. *Red shale*.....2′
4. Limestone, X of Stevenson's, Greene and Washington Co. series, fossiliferous, pure, in several layers separated by shales.....10′
5. *Red*, marly shale.....5′
6. Concealed, with sandstone visible at top.....30′
7. *Red shale*.....5′
8. Sandstone, sandy shales and concealed.....30′
9. *Red shale*.....10′
10. Sandstone, massive.....10′
11. Concealed.....35′
12. *Red shale*.....5′
13. Concealed.....25′
14. Sandstone, brown, massive.....10′
15. Sandy shales.....23′
16. *Red shale*.....2′
17. Sandstone.....25′
18. *Deep red shale*.....5′
19. Sandstone and sandy shales.....25′
20. Concealed and sandy shales.....20′
21. *Red* and marly shales with small scattered limestone nodules.....5′
22. Sandy shales.....15′
23. Sandstone, massive.....20′
24. Sandy shales.....15′
25. *Red shales* with small, limestone nodules.....5′
26. Gray, sandy shale.....2′
27. Sandstone, shaly and massive.....30′
28. Sandy shales.....3′
29. Limestone, impure.....2′
30. Sandy shales.....20′
31. *Coal, Washington*, upper half slaty.....4′
32. Sandy shales.....5′
33. Massive sandstone, *Lower Proctor*.....35′
34. Concealed and sandy shales.....25′
35. Concealed to low water in Ohio river at mouth of Fishing creek.....45′

Total.....558′

This entire section belongs to the *Permian* or *Permo-carboniferous series*, and is an admirable illustration of the general composition of those beds after passing above the horizon of the Washington coal, viz: a monotonous succession of *red shales*, and soft, micaceous, brown sandstones, and sandy shales, interstratified with which not a vestige of the small *coal beds* which are such a prominent feature in the lower 600′ of *Permian rocks* in Monongalia, Marion, and Marshall counties, is to be seen, unless two or three faint traces of fireclay may be considered as representing the *Jolleytown*, *Dunkard*, and *Nineveh coals* of those counties.

One member of the *Permian series*, however, appears in this section as a marked exception to the changing character of so many of the beds, viz: *Limestone X* of Stevenson's series, or No. 4 of the section. It seems to spread in an unbroken (except by erosion) bed from Washington county, Pa., south-westward through West Va., nearly to the Great Kanawha river, for I have found it caping the summits of the ridges near the western line of Jackson county, and never absent at its proper horizon from there northeastward to the Pennsylvania line. It seems to mark the basin of a great, inland sea, which in Permian times covered south-western Pennsylvania and a large portion of West Va., the larger diameter of which was rudely parallel to the Ohio river of the present.

The limestone is bluish gray, breaks with a sharp, clean fracture and is quite pure. It is filled with minute fossils, of which a univalve somewhat resembling *Spirorbis carbonarius*, Dawson, but different from it, is the most abundant. Along with this are other small shells that are seemingly bivalve crustaceans, allied to *Cypris* and *Estheria*. No marine forms were seen, and the great inland sea in which this limestone accumulated, was evidently fresh water, or but slightly brackish.

This limestone, from its wide distribution above water level in West Va., is of great economical importance to the farming and agricultural interests, and yet it has been almost entirely neglected by those most interested. The suggestive fact that wheat thrives with unexampled luxuriance on its outcrop and often for many rods below the same, seems to have given the farmer no hint that this lime could be used to great advantage over all his land, thereby increasing his wheat and other crops at least two-fold. There are probably not 20 farmers in West Va. that make any use whatever of this limestone on their land, and yet at least that many thousand of them have access to it, and could greatly profit by burning and scattering this valuable fertilizer over their lands, especially those intended for wheat. Luckily its position, so high up in the series of rocks, brings it far up near the tops of the ridges and knobs over a very wide extent of country,(and hence is often called "ridge limestone" by the farmers,) and thus by the natural means of solution and erosion it has fertilized large areas near the summits of broad, level-toped hills which it has been the agent in producing, and also a wide band of the slopes below, into which it has been carried by solution. Of this happy chance the farmer has long reaped the benefit, and thus this limestone has not been entirely wasted, though it has been through no good management of the agriculturists in these counties.

This limestone is a most valuable key-rock to the geology of the several counties of West Va. in which it is found, coming as it does 400' above the Washington coal, and 750'–800' above the Pittsburg bed. Its position in Greene and Washington counties, Pa., is only 400' below the highest of the Permian beds found there by Prof. Stevenson and myself in our survey of those counties in 1875

The Washington coal, No 31, has been mined to a small extent along Fishing creek for local supply, but the uper half is quite slaty and worthless. The section shows that this coal has sunk to 100' nearer river level than it was in the last section, 5 miles above New Martinsville. This rapid fall of the rocks is due to the fact that the Ohio river flows 15°–20° east of south from the locality of that section to the mouth of Fishing creek. Of course this dip carries the Pittsburg coal horizon down deeper to the same extent, and hence, if that coal be present in the series at New Martinsville, it would be found at a depth of 250'–300' below the bed of the Ohio river.

This depth is rather too great to warrant the expense of shafting at present, and New Martinsville should try the experiment of boring for natural gas of which, with little doubt, a most abundant supply could be obtained. The depth to the first gas bearing beds,would not be more than 1200 feet, but to reach the Wellsburg gas bearing sand at New Martinsville, the drill would have to penetrate the rocks to a depth of 1900'–1950 feet.

(To be continued.)

Section of the New River Coal series, No XII, at Sewell station on the C. & O. Ry.

Written for *The Virginias* by I. C. White.

Owing to the interference of rainy weather during our recent class excursion through the Kanawha valley, only a limited time could be given to the study of the New River coals. The one section measured,however, proved so important that its early publication is desirable, since it seems to show that the *Quinnimont coal seam*, or at least one coming near its place in the series, is persistent down the New river as far as Sewell (19 miles by river from Quinnimont), and hence may reasonably be expected to occur much farther northward, possibly until its horizon sinks below the bed of New river. Should this inference prove true, the measurements about to be given will be of value in exploring for the *Quinnimont seam*, where its horizon is covered up under a great thickness of talus and other trash, as it must be where the line of outcrop approaches nearer the level of New river northward from Sewell.

The following section was obtained in descending along the "incline" of the Longdale Coal Co., just above Sewell station :

1.	*Coal*, the one mined along New river from Sewell to Hawk's Nest, usually known as the "Nuttallburg seam"	2'-5'
2.	Concealed	85'
3.	Sandstone, massive	40'
4.	Concealed, sandstone and shales	210'
		335'
5.	*Coal*, Quinnimont	2' 6"
6.	Fireclay, impure	5'
7.	Shales and sandy beds	65'
8.	*Black slate*	2'
9.	Shales	15'
10.	Sandstone, massive, gray	25'
11.	Sandstone, sandy shales and concealed	200'
12.	Massive sandstone, visible	15'
13.	Concealed. sandy shales and sandstone	250'
14.	Concealed to level of New river	65'
		642'
	Total	982'

The coal, No. 5, which is identified in the above section with the *Quinnimont bed*, has been strangely overlooked by the Sewell Co., since its outcrop is plainly visible in the cut along their incline to the uper or *Nuttallburg seam*. It is also of workable thickness and as good coal as the one mined, if not better, judged by the aspect of its blossom.

No. 5 is the coal which is mined at Fire Creek, above Sewell, and it is also soon to be mined at another locality near Sewell.

That this bed is identical with the *Quinnimont seam* appears evident from the following considerations:

The top of No. XI, or the *Mauch Chunk shales*, must be near the base of the above section, or the bed of New river, since the *Nuttallburg coal*, No. 1, comes not less than 300 feet below the top of No. XII, and this added to the 982 feet of the section would give 1285' for the thickness of XII at Nuttallburg, which is as thick as any one has yet claimed

for this series on New river. (Prof. Fontaine makes it 1200').

The relation of the *Quinnimont coal* to the base of No. XII is shown by the following section, which I took there last year in company with the University class of 1882 :

1. Dark slate and shales	10′	
2. *Coal, Quinnimont*	2′-4½′	
3. Concealed with a *coal* reported at 60′ below Quinnimont bed	260′	
4. Sandstone, massive	25′	
5. Concealed	60′	620′
6. Sandstone, massive	25′	
7. Concealed and flagy sandstone	200′	
8. Sandstone, massive, pebbly, base of XII	50′	
No. XI., Greenbriar shales, etc.		
9. Red shale, top of XI or Mauch Chunk	40′	
10. Shales, red, green and variegated	120′	
11. Sandstone, massive, greenish	20′	390′
12. Drab shales	140′	
13. *Limestone*, sandy	5′	
14. Concealed to level of New River	65′	
Total	1,025′	

By comparing this section with the previous one, it will be seen that the horizon of the *Quinnimont coal* comes at the same interval (620′) above the base of No. XII that the lower coal bed at Sewell does above New river there, and since, for reasons already given, the New river's bed must be near the top of No. XI at Sewell, it follows that coal No. 5 of the Sewell section must be identical with the *Quinnimont seam.*

The limestone No. 13 of the last section is one of the impure beds which nearly always occur at some distance above the main mass of the Mountain or Greenbriar limestone.

Mr. Jas. F. Lewis, Supt. of the Quinnimont furnace, had an analysis of this limestone made to learn if it was sufficiently pure for use as a flux at the furnace The result was unsatisfactory, as will be seen by the following analysis, for a copy of which I am indebted to Mr. Lewis :

Carbonate of lime	71.51
Silica	22.74
Oxides of iron and alumina	3.76
Magnesia	1.66
Phosphoric acid	0.066

Analysis by Dr. Thos. M. Drown, of Easton, Pa.

Coal and Coke Traffic of Ches. & Ohio Ry., July, 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during July, 1883, and July, 1882, in tons of 2000 lbs., compiled by fuel agent, C. M. Gibson :

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	3,167	4,016	.....	849
Gas	34,903	34,101	807	.....
Splint and block	6,433	9,930	....	3,497
New River, &c	32,956	28,446	2,520	.....
Coke	7,913	5,975	1,938	.....
Totals	83,387	82,463	5,265	4,346

The net increase in the movement during July, 1883 over that in July, 1882, was 919 tons, or but little over one per cent. Compared with the previous month, June, 1883, (See page 102), there was a net decrease of 846 tons ; all in the movement of cannel and gas coals, for there were handsome *increases* in the movement of splint and block and New River coals and coke.

The distribution of the above was as follows:

	1883.	1882.
1. To C. & O. Co. for its own use	21,342	16,595
2. To Huntington, for West via Ohio river	3,400	2,546
3 On Elizabethtown, Lexington & Big Sandy RR	1,141	2,688
4. On Ches. & Ohio Ry., excepting Richmond.	13,555	908
5 To Richmond & Alleghany RR. at Cliften Forge.	335	105
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	.....
7. To Shenandoah Valley RR. at Waynesboro	.....	1,868
8. To Va. Midland Ry. { At Charlottesville	2,166	7,279
{ At Gordonsville	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR. Junc.	83	168
10. To Richmond for consumption, including tugs, &c	6,496	11,889
11. To James River wharves for shipment	12,296	14,257
12 To Newport News { Consump'n includ'g tugs &c,	252	.....
{ For shipment	22,321	24,165
Totals	83 387	82,468

The striking features of the above distribution are the very large increases in the quantities of coal consumed by the C. & O. and distributed on its line west of Richmond ; showing the great increase in the business of the railway and the great activity that prevails in the manufacture of iron along its line.

The following table presents the progressive traffic from January 1 to July 31, inclusive, for 1883 and 1882 :

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	17,935	17,221	714	.....
Gas	221,019	186,824	42,195	.....
Splint and block	57,896	78,155	.....	20,259
New River, &c	239,784	198,836	40,948	.....
Coke	63,960	52,235	11,725	.....
Totals	608,594	533,271	95,582	20,259

This shows a net gain of 75,323 tons, over 14 per cent, in the yearly movement up to August 1st.

Calculating the Thickness of Strata.

Lexington, Va., Aug. 6, 1883.

Maj. Jed. Hotchkiss :

Dear Sir :—The accompanying table was prepared at my request by Mr. Harry D. Campbell, who has been mentioned in your columns as instructor in Chemistry and Geology in Washington & Lee University during the protracted illness of his father, Prof. J. L. Campbell. Mr. Campbell has had experience in field geology, and promises to excel.

The table of figures I have used for a year past, and found very convenient.

Very truly, W. H. Ruffner.

Table, prepared by Harry D. Campbell, by which to calculate the thickness of strata from the horizontal measure of the outcrop at right angles to the strike, dip known.

For 2° dip,	multiply	meas. hor.	by	.035	For 35° dip,	multiply	meas. hor.	by	.574
" 4° "	"	" "	"	.070	" 38° "	"	" "	"	.616
" 6° "	"	" "	"	.105	" 41° "	"	" "	"	.656
" 8° "	"	" "	"	.139	" 45° "	"	" "	"	.707
" 10° "	"	" "	"	.174	" 50° "	"	" "	"	.766
" 12° "	"	" "	"	.208	" 55° "	"	" "	"	.819
" 14° "	"	" "	"	.242	" 60° "	"	" "	"	.866
" 16° "	"	" "	"	.276	" 65° "	"	" "	"	.906
" 18° "	"	" "	"	.309	" 70° "	"	" "	"	.940
" 20° "	"	" "	"	.342	" 75° "	"	" "	"	.966
" 23° "	"	" "	"	.391	" 80° "	"	" "	"	.985
" 26° "	"	" "	"	.438	" 85° "	"	" "	"	.996
" 29° "	"	" "	"	.484	" 90° "	"	" "	"	1.000
" 32° "	"	" "	"	.530					

Notes on the Mineral and Thermal Springs of the Virginias.

Among the most interesting of the writings of Prof. Wm. B. Rogers that will appear in the volume of his works on Virginia, now passing through the press of D. Appleton & Co. of New York, are two papers on the springs of the Virginias; one treating of those whose waters are *thermal* in character, that is having a temperatrue greater than that of the mean annual temperature of the place where they are found, without special reference to the character of their waters, though giving their composition and accounting for it and their temperature by connecting them with certain geological formations and with faultings and foldings, to a greater or less depth, of the rock beds that are embraced in these formations; the other treating of these springs as *mineral waters* and devoted mainly to chemical analyses which give the kinds and quantities of the ingredients found in these waters, and that give them their character as mineral or medicinal springs,—From advance sheets of these two papers (but freely using all other sources of information) we have gathered most of the facts for the following notes on some of these springs, concieving that such information will be of especial interest in this month of August when the "springs season" is at its meridian.

Classification of Mineral Springs.—From the standpoint of the analytical chemist, viewing only the characteristic or typical ingredients of the mineral springs of the Virginias, Prof. Rogers divided them into the following six classes:

1. *Carbonic or Acidulous*, in which carbonic acid and the carbonates, especially those of lime and magnesia, give character to the waters.
2. *Sulphurous*, in which sulphureted hydrogen or hydrosulphates, or both, are predominant.
3. *Alkaline*, characterized by carbonate of soda.
4. *Chalybeate*, in which the oxide or the carbonate of iron is prevalent. When the carbonate prevails the carbonic acid, which holds up the carbonate of iron, is often sufficient in quantity to render the spring decidedly acidulous, making its waters *Acidulous-chalybeate.*
5. *Sulphuric or Alumino-Chalybeate*, containing, chiefly, sulphates of alumina and iron with free sulphuric acid.—These are the alum and copperas springs.
6. *Brine springs*, marked by the predominance of common salt or chloride of sodium.

The principal ingredients found in these springs are: carbonates of lime, magnesia, soda, iron and alumina; sulphates of lime, magnesia, soda, iron and alumina; chlorides of sodium, calcium and magnesium; sulphides of sodium and magnesium; sulphureted and carbureted hydrogen; iodides, bromides, silica, caustic soda, hydrosulphuret, organic matter, carbonic acid, oxygen and nitrogen

1. *The White Sulphur Springs*, Greenbrier county, West Virginia, are on the line of the Chesapeake & Ohio Ry., 227 miles north of west from Richmond, Va., and 194 miles southwest from Huntington, W. Va.; the railway station is 1,920 feet above the level of the sea. The geographical location of the White Sulphur Springs is about north latitude 37° 40′ and west longitude 80° 20′, but the elevation of the place makes its climatic latitude 44° north, about that of Portland, Maine, at the sea-level.

These springs are on the westward slope of Alleghany mountain, 5 miles from the crest of that range, consequently near the western border of the Apalachian region, or natural grand division, of the Virginias, and on Howard creek, a tributary of Greenbrier river, that heads on Alleghany mountain and flows southwest and west, entering the Greenbrier about 6 miles below the White Sulphur.

Geologically speaking the region in which these springs are located is a Devonian one, most of the exposures of rocks being the slates, shales, sandstones, etc., of Rogers' formation No. VIII—the Marcellus, Hamilton, Genesee, Portage and Chemung rocks of New York,—but the springs are in the southwestern end of a narrow oval area, some 5 miles long, of an anticlinal exposure of Upper Silurian rocks, Rogers' formations IV–VII, and the springs themselves issue, according to Prof. W. B. Rogers' observations, from a cracked anticlinal axis of formation No. VII, the Oriskany sandstone of New York. This anticline bears on its flanks, of course, formation No. VIII, as above described.

In his paper on "Thermal Springs" (1842) Prof. Rogers writes as follows: "The White Sulphur axis, exposing For. VII, at the springs, dies out in a short distance towards the southwest; but traced in the opposite direction, expands into a considerable ridge bringing into view the upper part of For. VII, here of considerable thickness, and eventually terminates in a roll of the slates of For. VIII, near Anthony creek. In the neighborhood of the springs the flexure of the strata is remarkably abrupt, the gentle slope on the southeastern passing into a vertical or slightly inverted dip on the opposite side of the axis. With the exception of this and another adjacent but very inconsiderable line of exposures, the surface for many miles on either side is occupied by the slates and sandstones of Fors. VIII and IX, bent and contorted by numerous lesser axes, and in the Alleghany mountain and the numerous adjoining hills, carved by denudation into a variety of picturesque forms.

The waters of the White Sulphur are copious, but accompanied by very little evolved gas. The few bubbles I have succeeded in entraping, proved to be nearly all nitrogen, but it is uncertain whether they arose with the water from the depths below, or were developed in the basin of the spring.

Though decidedly thermal, these waters have a fluctuating temperature, never, however, as I think, approaching nearer than ten degrees to the atmospheric mean.

They form the only instance within my knowledge of a strongly sulphureous and at the same time thermal water in the United States; and in these respects bear a close analogy to certain thermals of the Pyrenees."

Prof. Rogers classed the White Sulphur with the *thermal* springs, having found the temperature of its waters 61° to 65° Fah., saying their "temperature is variable with the seasons and the weather, but always *thermal*"; Dr. Moorman (See Mineral Springs of N. A., p. 63) claims that they have an *invariable* temperature of 62°. Dr. Daubeny, of England, who visited these springs, did not advert to their being thermal. (Silliman's Journal, Apr., 1839).

The quantity of solid matter in 100 cubic inches of White Sulphur water, obtained by evaporation and weighed after being dried at 212°, was found by Prof. Rogers to be 65.54 grains, composed of the following constituents:

Sulphate of..	Lime	31.680	grains
	Magnesia	8.241	"
	Soda	4.050	"
Carbonate of.	Lime	1.530	"
	Magnesia	0.506	"
Chloride of...	Calcium	0.010	"
	Magnesium	0.071	"
	Sodium	0.226	"
Proto-sulphate of Iron		0.069	"
Sulphate of Alumina		0.012	"
Earthy Phosphates		a trace.	
Azotized Organic Matter, blended with a proportion of Sulphur, about		5 grains.	
Iodine, a marked amount, combined with Sodium and Magnesium.			

In 100 cubic inches of the water from the White Sulphur spring Prof. Rogers found the following gases, by volume, in a free state:

Sulphureted Hydrogen	0.66 to 1.30	cubic inches.
Nitrogen	1.88	" "
Oxygen	0.19	" "
Carbonic Acid	3.67	" "

Prof. Rogers remarks: "While the proportion of the saline ingredients has been found to suffer but little variation with the season and the weather, that of the Sulphureted Hydrogen and the Sulphur united with Azotized Organic Matter has never been observed to show very marked fluctuations."

In Rogers' paper on "Thermal Springs" the amount of Nitrogen in 100 cubic inches is stated as 1.78 and of Carbonic Acid 2.07 cubic inches.

In regard to the deposits that gather on the sides of the White Sulphur, and other springs, Prof. Rogers makes these interesting statements: "The *plumose, filamentous* growth, involving a large amount of hydrated sulphur, which lines the basin and outlet of these waters, and which from its color has given rise to the name of White Sulphur, is also found in other sulphureous springs in the state, and has caused the adoption of this name as descriptive of such springs as a *class*, notwithstanding their want of agreement in other and far more important particulars. Organic products of another kind, developed in the enclosures of the Red, Blue, Gray, Crimson and Green Sulphur Springs, and whose true nature was also first suggested by myself, (See Hare's Chemistry, 1838,) have by a like connection originated the names by which these springs are respectively known. Observations beyond, as well as in the state, have satisfied me that similar organic products are to be met with, in one or more forms, in *all the snlphureous waters* of the Apalachian belt and that they are *peculiar* to waters of this class. Having read with great interest Dr. Lankester's "notice of the plants and animals found in the sulphureous waters in Yorkshire," as given in the Report of the British Association for 1840, I have been much gratified at finding these opinions corroborated by the observations of that gentleman in regard to the sulphureous waters of Harrowgate, Askerna, and the neighboring district, and I have enjoyed no little surprise in recognizing in the conferva which in those places "collects in large quantities around the sides of the wells," and in the animal deposit, "varying from a light pink to a rose color," the objects which impart such beauty to some of our celebrated sulphureous springs, and which six years ago I pronounced to be of "vegeto-animal" origin. I may here add, by an experiment made at that time on the water of the White Sulphur, which in its basin and outlet produces little or none of the rose-colored deposit, I found that I could at will give rise to it by collecting the liquid in an adjoining cavity in the dark sulphureous mud—and I remarked that *before* the material of the rosy film collected on the surface beneath, it continued diffused in the liquid for some time like a faint pink cloud, changing its position and its density. This, with other observations, suggested the idea of its being due to animalcuæ, which under certain favorable conditions as to light, and perhaps temperature, quiescence, and the contact of particular substances, would always display themselves in our sulphureous waters. For the distinct determination of the forms and relations of these organic objects by the microscope, we owe our thanks to Dr. Lankester."

Among the springs containing free Sulphuric Acid, Prof. Rogers mentions the *Sour Spring* near the White Sulphur, and gives the following contents in 100 cubic inches of its water:

Sulphuric Acid	48.830 grains.
Protoxide of Iron	12.120 "
Alumina	16.206 "
Lime	5.648 "
Magnesia	a trace.

In the winter of 1842 Mr. Aug. A. Hayes, of Roxbury, Mass., made an analysis of White Sulphur water from samples sent him in the fall of 1841; from his report, as quoted by Dr. J. J. Moorman in his "Mineral Springs of North America," we gather the following:

Specific gravity, compared with pure water ....1.00254.

Gaseous matter in 50,000 grains (about 7 pints) of this water, 3.683 water grains, about 1.14 of its volume, consisting of:

Nitrogen gas	1.013	Carbonic acid	2.444
Oxygen gas	.108	Hydro-sulphuric acid	.068

One gallon (237 cu. inches) of this water contained 16.739 cubic inches of gas in these proportions:

Nitrogen	4.680	Carbonic acid	11.290
Oxygen	.498	Hydro-sulphuric acid	.271

In 50,000 grains of the water he found 115.735 grains of saline matter, as follows:

Sulphate of..	Lime	67.168
	Magnesia	30.364
Chloride of Magnesium		0.859
Carbonate of Lime		6.060
Organic Matter (dried at 212° Fah.)		3.740
Carbonic Acid		4.584
Silica 1.34. Potash 0.18, Soda 0.66, Magnesia, and trace of Iron oxide		2.960

Mr. Hayes calls attention to the fact that the sulphates of lime and alumina form nearly 10-11ths of the saline matter in these waters, the chlorine, (unlike saline sulphureted waters generally) being a minute proportion; and that the alkaline bases are also in small proportion and seemingly united to the silicious earths in combination with a peculiar organic matter. He also says that this water in contact with earthy sulphates at a moderate temperature produces hydro-sulphuric acid; and that to this source may be traced the sulphuric acid found in the water; also that the proportion of organic matter found in this water is very small, but to that he refers, as the most probable source, the medicinal properties of these waters, though in conclusion he appears to claim that the hydro-sulphuric acid of these waters is their great and chief remedial agent, that acting chemically in the stomach after the water has reached it.

As the result of his extended observations on the thermal and mineral springs of the Virginias and of his deductions from data concerning those of other countries, Prof. Rogers arrived at the conclusion that the temperature of the waters of these springs depends on the depth in the crust of the earth from which they flow, the temperature increasing somewhat regularly from the surface downward; consequently the waters of hot springs come from far down in the earth, those of warm springs from a less depth, and those of cool or cold springs from only a moderate depth; he also inclined to the conclusion that the character and composition of these waters were mainly due to the action of the internal waters of the earth, and their contained gases, on the rocks, earths etc., that they come in contact with in their passage to the surface.

Adopting Prof. Rogers' conclusion that the temperature of the earth increases downward at the rate of 1° for every 60′ of depth (See paper on "Subterranean Temperature in the Coal Mines of E. Va.") and the statement that the water of the White Sulphur averages about 10° higher than the mean of its locality, we must conclude that this spring flows

from a reservoir 600′ to 700′ under the surface; a depth that would place that reservoir on the Clinton (No.V) sand-rocks and in the Lower Helderberg (No. VI) limestones, assuming that these limestone beds have the thickness they disclose to the eastward in Apalachian Virginia.

Entertaining this idea of the location of the reservoir of the White Sulphur springs, we conceive that its waters are the meteoric ones of the uper portion of the catchment basin of Howard creek percolated through the rocks of formations VIII, VII and VI, and gathered in a limestone cavern of VI as a receiving reservoir. An inspection of the preceding analyses of these waters will convince anyone that they are essentially *limestone* ones, the larger proportion of their solid ingredients being lime and magnesia, such as meteoric waters —nature's universal solvents—would dissolve from the No. VI limestones. The aluminous shales and slates of formation VIII—as anyone can see that will critically examine them in the railway cuts and ravines near these springs—can supply to percolating waters all the other ingredients that enter into the make up of these invigorating and health-restoring waters.

2. *The Rockbridge Alum Springs*, Rockbridge county, Virginia, are about 8 miles southwest from Goshen station of Chesapeake & Ohio Ry, a point 168 miles northwest from Richmond, Va., and 254 southeast from Huntington, W. Va. The narrow-gauge railway of the Iron & Steel Association of Va. conveys passengers from Goshen to the vicinity of these springs. Goshen is 1410 feet above the sea-level and these springs are several hundred feet higher — Their location is in the uper portion of the valley of Bratton run, a stream that flows northeast into Big Calf-pasture river of North river of the James. Mill mountain, at the eastern base of which are these springs, bounds this valley on the west and Bratton mountain and its extension, North mountain, bound it on the east; an intermediate mountain, Brushy ridge, from the southwest, terminates near the springs. These are typical Apalachian ranges, long, straight, narrow, steep and parallel.

These alum springs, as they are called, are waters that have percolated through the shales and slates of formation No. VIII and are gathered in cavities cut into the base of cliffs of these shaly and slaty rocks. Prof. Rogers classes these springs among those containing free sulphuric acid; he found their temperature varying from 50° to 56°, and the contents of 100 cubic inches of the water as follows:

Sulphuric Acid		14.398 grains.
Sulphate of..	Iron protoxide	2.035 "
	Alumina	6.916 "
	Lime	0.150 "
	Magnesia	a trace.

These contents show that these springs are *Sulphuric* or *Alumino-Chalybeate* ones.

Prof. Hayes, of Boston, Mass., in 1852, found in a gallon of this water the following ingredients:

Sulphate of..	Potash	1.765 grains.
	Lime	3.263 "
	Magnesia	1.763 "
Iron protoxide		4.863 "
Alumina		17.905 "
Ammonia crenate		0.700 "
Sodium chloride		1.008 "
Silicic acid		2.840 "
Carbonic acid		7.356 "
Sulphuric acid, free		15.224 "
Total mineral contents		56.687 "
Pure water		58,315.313 "
Total contents		58,372.000 "

Dr. Moorman calls these waters *aluminous sulphated chalybeate.*

The Jordan Alum Springs form a part of the Rockbridge Alum Springs property; their waters are gathered from the same source and consequently are similar.

Col. Wm. Gilham, of the Va. Military Institute, found in one gallon of this water the following ingredients:

Sulphate of..	Alumina	5.689 grains.
	Magnesia	4.666 "
	Lime	3.808 "
	Potash	0.658 "
	Iron protoxide	8.398 "
Sulphuric acid, free		8.858 "

Sodium chloride and organic matter, not determined.

One need not go far to look for the origin of the ingredients of all these alum waters; they are in the slates and shales of formation No. VIII and the meteoric waters assimilate them in percolating through these rocks from the surface to the pools or springs.

Coal River, W. Va., Lands and Railway.

One of the best portions of the grand coal basin and timber region of the Great Kanawha river, West Virginia, is the portion of it drained by Coal river; the development of that section has been for years the special labor—largely one of love we are bound to say—of our good friend Major Thomas L. Broun, of Charleston, W. Va. Moved thereto by a recent visit of some Scotch capitalists, who visited that basin of abounding resources, and were so pleased as to desire to take home to their friends some reliable account of it, Maj. B. has prepared a new bulletin, headed "Coal River Land and Railroad Enterprise," with copies of which he has favored us. From these we make the following interesting extracts, the reliability of which we unhesitatingly endorse.

Coal river empties into the Great Kanawha at St Albans (Coalsmouth) 12 miles below Charleston, and 45 miles above the mouth of the Great Kanawha, which empties into the Ohio at Point Pleasant, 200 miles above Cincinnati, and 275 miles below Pittsburg.

The area drained by Coal river and its tributaries, above the forks of Coal, embraces 1,000 square miles, or 640,000 acres of land, heavily timbered with oak, poplar, chestnut, cherry, walnut, hickory, ash, elm, hemlock, etc., and contains from 4 to 10 workable beds of the very best splint, cannel and bituminous coals, above water level and croping out on the hill and mountain sides.

About nine-tenths of the Coal river region is covered with timber, and a large portion of the timber is in its virgin state. There is a brisk demand both in the East and West for most of the thirty-two varieties of timber found on the Coal river lands.

For variety and superiority of coal, for the number and thickness of coal beds, for advantages in mining, and for proximity to both Eastern and Western markets, the country drained by the Great Kanawha river and its tributaries —Coal river, Elk river, New river and Gauley river—is regarded by eminent geologists as the most valuable coal field in the world.

The birdseye cannel of Coal river equals the best English cannel as a fuel, and the "Peytona cannel" from Big Coal river is most favorably known in New York City by gas consumers. In New York City alone twenty million bushels of Coal river cannel coal can be sold every year, with large profit. In Cincinnati, Louisville and other western cities, this cannel coal brings from 40 to 50 per cent more per bushel than the Pittsburg coal.

The Coal river bituminous coal equals the best found in Pennsylvania, whilst the Coal river splint coal, as a fuel, is

unsurpassed. On the head waters of Big and Little Coal rivers are found thick beds of superior coking coals.

The splint and cannel coal deposits of West Virginia lie, almost exclusively, within a belt of country about 40 miles wide, runing northeast and southwest, and situated between and parallel with the Ohio river and the Alleghany mountains. This belt embraces nearly all the land drained by the waters of Big and Little Coal rivers. Within this belt and just above the forks of Coal are found workable beds of good coal, that is beds 3 feet thick and upwards. As you ascend Big or Little Coal river the mountains become higher and the beds of coal increase in number and thickness, until the maximum amount of coal, 40 feet of thickness in the aggregated beds, is reached 15 miles above Peytona and 20 miles above Boone C. H. In fact, Coal river coal lands lie in the very heart and centre of the West Virginia coal-field. They contain more deposits of cannel coal than are found in all other portions of the Great Kanawha coal field, and they are situated nearer and are more accessible to the western markets than any other part of the Great Kanawha coal-field.

Cincinnati, Louisville and other cities on the Ohio and Mississippi rivers constitute the chief markets for our splint and bituminous coals. At present, Cincinnati alone uses sixty million bushels of bituminous coal annually, which is supplied chiefly by Pittsburg. The upper Ohio towns and Pittsburg send, every year, one hundred million bushels of bituminous coal down the Ohio river, past the mouth of the Great Kanawha river, to Cincinnati and elsewhere on the lower Ohio and Mississippi rivers. And this trade is increasing every year, with the rapid growth of the Great West and Southwest. The Great Kanawha coal-field should furnish these one hundred million bushels annually; and no portion of the Great Kanawha coal-field offers such favorable inducements to capitalists to supply this western demand for coal as the Coal river region.

Coal boating stages on the Kanawha (7 feet of water) are more frequent from St Albans to Cincinnati than they are from Pittsburg to Cincinnati. Furthermore, the construction by the United States government of Lock and Dam No. 7, of the Great Kanawha slack-water improvement, just below the mouth of Coal river, will create an excelent harbor in Coal river for several miles, where the Coal river coal can be dumped from the cars into the boats and barges. The construction of this lock and dam will be under the direction of United States engineers, the site for the same having been already selected and paid for by the government.

Cannel coal can at times be sent from St Albans, down the Kanawha, Ohio and Mississippi rivers to New Orleans, and thence to New York, as ballast, at less cost than over the Chesapeake & Ohio Ry. to New York.

The best coal, thickest beds, most reliable deposits, and greatest number of beds, are found in the main mountain ridges separating the waters of Little Coal river from Big Coal river, and the waters of Big Coal river from the Great Kanawha river. It is the coal in these dividing ridges that coal companies are seeking, and the present indications show that the coal deposits in the "divide" between the Big Coal river and the Great Kanawha will be the first to reach a maximum development and bring Pittsburg prices per acre.

When it is considered that only a small portion of the West Virginia coal field will be needed to supply all demands on it for coal for a century to come, it is very important to the purchaser of coal lands to buy lands that will most quickly be developed and prove remunerative. And what part of the vast coal field of West Virginia contains such coal? This is the important question for investors to decide. The Coal river region claims, on account of its advantages herein mentioned, to present the greatest inducements for speedy development and profitable investment.

The Coal river lands are naturally fertile, producing wheat corn, oats, tobacco, grass, &c., and affording fine pasture ranges for cattle and sheep. Workable veins of excellent black band iron ore, fine sandstone for building purposes, and fireclay are found in numerous localities on Coal river and its tributaries.

Coal and iron, and their proximity to one another, it is said, constitute the substratum of England's prosperity and commercial supremacy. Virginia and West Virginia have the same elements of future wealth and greatness, and no where are coal and iron so favorably located, and in such close proximity to each other as they are along the proposed Coal River Railroad and the extension thereof into the state of Virginia.

A railroad from St. Albans to the Coal river coal lands would make these lands more accessible by water to Cincinnati than the Monongahela and Youghiogheny lands are. A railroad 12 miles in length, from the Kanawha river at St. Albans, will reach Coal river coal lands At St. Albans, the Coal River RR. will connect with the Chesapeake and Ohio Ry, thereby giving an Eastern outlet to the superior cannel coal of Coal river, and to Coal river timber. Just opposite St. Albans, the Coal River RR. can connect with the Ohio Central RR., thereby giving an outlet to Columbus, Toledo and Chicago, for Coal river timber and coals. The Norfolk and Western Railroad will, ere long, be extended through the Flat-top mountain into the West Virginia Coal field. This will give another Eastern outlet to Coal river products.

The Coal river coal field can be utilized and successfully developed only by means of a railroad, as thereby regular and reliable transportation at all seasons of the year is furnished; and those owning and controling the Coal River Railroad will have the key that is to unlock the coal, timber, iron and other interests of the 640,000 acres of land situated on Coal river and its tributaries. A railroad can easily and cheaply be constructed up Coal river with good grade; the fall in the river from Peytona to St. Albans being three feet to the mile. This railroad, when completed, will extend from the Great Kanawha river at or near St. Albans through a region of country in West Virginia unsurpassed for its timber and extensive deposits of superior splint, cannel and bituminous coals.

The Coal River RR., can, not only be a very important and profitable coal, iron and lumber road, but it may become part of a grand trunk line, connecting Richmond, Norfolk, and other cities on tide-water with Cincinnati and Chicago. As part of a through line, the Coal River RR. would pass through the most extensive deposits of superior cannel coal in the United States, thence it would enter the south-western part of the state of Virginia, where abound iron, copper, gypsum, salt, nitre, zinc and other minerals in the greatest abundance.

Big Coal river flows nearly parallel with the Great Kanawha. Three railroads, to wit:—Davis Creek road 15 miles long, Fields Creek 6 miles long, and Cabin Creek 10 miles long—have already been constructed from the Kanawha river and the Chesapeake & Ohio Ry to the "divide" separating these rivers and they will soon penetrate the Coal river side, by tunnels through coal banks in the mountains. Two other railroads are partly constructed to said "divide," to wit:—The railroad up Paint creek and the railroad up Morris creek. (See "The Virginias" for January, 1883.)

On the 10th of February, 1872, the legislature of West Virginia granted a most favorable charter, with perpetual rights, powers and privileges, to Thomas L. Broun and certain other Coal river land-owners, with a capital stock of $2,000,000; shares, $100 each. Under the present constitution of West Virginia no more such railroad charters can

be granted; therefore the Coal River Railroad charter has a special value.

This charter and the amendments thereto, enable the "Coal River Railroad Co.," to purchase and sell lands; to mine, transport and sell coal, iron and other minerals; to carry on the lumber business; to build branch roads 50 miles in length; to transport freight and passengers and charge for same; to increase its capital stock; to borrow money at rates not to exceed 10 per cent per annum; to sell its bonds at a discount; to execute mortgages on its property; to have its chief office in New York or elsewhere; and to construct a railroad from the Great Kanawha up Coal river to the Forks of Coal, thence up Big Coal river, or Little Coal river, or both Coal rivers, to the head waters thereof, thence to the state line in Monroe, Mercer and McDowell counties.

Memorial to Prof. Wm. B. Rogers.—The Corporation of the Massachusetts Institute of Technology has named the original building of that institution the "Rogers Building," in recognition of the eminent services of Professor William B. Rogers as the founder and organizer of the "Institute."

At the close of the graduating exercises, May 29th, 1883, President Walker announced this action of the Corporation with the following appropriate remarks, which we know will interest all our readers:

Members and Friends of the Massachusetts Institute of Technology:—Here, in this hall, one year ago, occured an event which seemed at the time, indeed, most tragic and terrible. A great and good man, who for thirty years has been one of the most conspicuous figures in this cultured community, whither he had come from a distant State, already crowned with the highest honors which genius can command; who had in his own person exemplified with a rare fidelity all the virtues of the scholar and the citizen, to which was added the supreme grace of a philosophic eloquence that made his expositions of scientific truth radiant with a light which scarcely seemed to come from earth,—this man, whom we honored and loved, to whom we looked up as to master, teacher, father, fell, an unfinished sentence on his lips, instantly dead in our midst.

He had begun the wonderful story of electrical invention, when, without a warning, the clarion voice ceased, suddenly as when the electric circuit is broken; on the half-spoken thought fell the veil of eternal silence; over the eye that even at the instant flashed fire was drawn the film of death.

At the time, in the act, it seemed to every spectator a tragedy complete with all the elements of terror and of grief. Yet to me, at least, even before that stately and beloved form was laid in the grave, the whole character and bearing of the event had undergone a transformation.

I saw that only a scaffolding had fallen, revealing to the view the sublime perfection of a truly finished life. What place could have been better suited for that farewell to earth? "Dying in harness" had for years been a favorite phrase upon his lips; and at last he died, a good knight, indeed, full-panoplied and at his post.

What ending could have been more sublimely appropriate to a life so chivalric? Where else, and how otherwise, should he have died than among his own works, in the very act and part of self-denying duty?

And now the Corporation of the Massachusetts Institute of Technology, gratefully recognizing William Barton Rogers as the founder of this school of industrial science, entertaining a profound appreciation of his vast and varied gifts, and of his vast and varied works in the interest of science, education, and human progress, and desiring to hold up his name and character to the youth who, through future generations, shall enter this school, as a bright example of high manhood, of scientific enthusiasm,, and of heroic devotion to duty, do, here and now, affix to this structure, as its official title, in perpetuity, the name,—"The Rogers Building."

The Mass. Institute of Technology Virginia excursion.—In our last issue we refered to the geological class of the Massachusetts Institute of Technology, Boston, that had been studying the rocks and minerals of the Virginias; under date of July 4th, 1883, Prof. Robert H. Richards writes us as follows:

"We have arrived home safely after a most delightful trip. After leaving Clifton Forge we went to Low Moor, where Col. Goodwin welcomed us very cordially. Besides looking over the furnaces and mines at that place, we heard that they had just struck a new limestone cave in their limestone quarry. Accordingly the whole party were crazy to get into it. We climbed up and in and found not only some nice limestone stalactites but we found also an exceptionaly fine set of iron limonite stalactites. We got ourselves about as mudy as you ever saw a lot of fellows. Mrs. R. could not resist the fever, and she too, like the rest, climbed up, hand over hand with scarce foothold enough to catch the tips of her toes upon. I think that I have made up my mind that ladies can do about anything that they make up their minds to do.

We spent a pleasant day with Mr. Lewis at Quinnimont, and four days with Mr. Buck at Coalburg, both of which periods were very instructive to us all.

The members of our party have again and again expressed the pleasure they received from your welcome lecture. It came at just the right time and the boys appreciated it."

The members of this excursion were: Prof. J. M. Ordway and wife, Prof. R. H. Richards and wife, and students F. M. Haines, E. Morss, and E. T. Sturgis, Boston, Mass.; W. H. Bunce, Hartford, Conn.; W. S. Allen, New Bedford, Mass.; T. C. du Pont, Louisville, Ky.; G. H. Heywood, Gardner, Mass.; H. Mac Rae, Wilmington, N C.; T. W. Robinson, and C. Snelling Robinson, Wareham, Mass.; D. Wesson, Brookline, Mass.; and N. Ward Roxbury, Mass.

We observe that Mr. David Wesson was one of the graduates of the Institute this year, and that his thesis was on the "seting of cements."

The University of Virginia.—It will be a source of pleasure to the friends of the University of Virginia everywhere to learn that the session just closed was one of decided success in every way. In the number of students it was considerably in advance of the previous session, whilst in the character of the habits of the students and their diligence and advancement in studies, it was an eminent success. The large number of distinguished proficients, graduates and degree students turned out the past session fully attest the hard work done, especially when the very high standard required to win these honors is considered. It will be particularly gratifying to Marylanders to learn that Prof. Garnett, formerly president of St. John's College, Annapolis, is wining favorable opinion in his sphere as head of the English department of the University. The astronomical department, under Prof. Stone, is very efficiently developed.—Recently professors for eleven different chairs or departments in colleges, polytechnic schools and other institutions of higher learning in the United States have been elected from the alumni of the University of Virginia, and others soon will be added to the long roll of honor which has heretofore been made from her alumni.—*Baltimore Sun*, July 12, 1883.

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Jed. Hotchkiss, - Editor and Proprietor.

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Prof. I. C White's interesting paper, that we publish on page 139, should have for its title "The Terraces of the Monongahela valley and other West Virginia tributaries of the Ohio, on the hypothesis of a Glacial Dam at Cincinnati"; the paper from which we took it had a misleading title.

Washington & Lee University opened its session of 1883–4 with bright prospects, 120 students were in attendance on the third day, a much larger number than usual. One of the most gratifying incidents, to us, of the opening was the resumption by Prof. J. L. Campbell, with restored health and his accustomed intellectual vigor, of the Chair of Geology and Chemistry that he so ably fills.

Cincinnati Iron Market.— Rogers, Brown & Co., under date of Sept. 24, 1883, write *The Virginias*:—A good deal of pig iron has changed hands the past week and negotiations are in progress for other lots of considerable size. Many large buyers have enough faith in the market to make liberal contracts, if they can force holders to concessions in prices. The general run of buying, however, is for immediate delivery to cover immediate wants. So far as this section is concerned, it is believed consumption is runing up to the full limit of former years. Where talk is heard of reduced orders and dullness, it refers in many, perhaps most, cases, to prospective rather than present business. On all lines of the trade the tendency is to conservatism, people buying about as much as formerly, but buying close and for immediate requirements only. This naturally leads to much doubt and speculation about the future. There is renewed talk about furnaces blowing out, but no actual stoping worthy of note. Demand continues about uniform for the different grades.

Three Decades of the Growth of Virginia.

In the year 1873, the Editor of this journal wrote "A Geological and Political Summary of Va." for the Board of Immigration of that state which was published, in an octavo volume of 320 pages, in 1876. As originally written the facts of its population, productions, etc., were given as presented in the U. S. census reports of both 1860 and 1870, intending by so doing to show the statistical condition of Virginia, as now constituted, at the census of 1860, which immediately preceded the Civil war, and at the census of 1870 which was taken not long after that destructive event. This volume was published as originally written except the chapter, IV, on the Productions of Virginia. A majority of the Board of Immigration agreed with the author that it was best to present these facts of condition to the world as they had been prepared, even if they did make a bad showing in the comparison invited between a decade of prosperity that had passed and one of adversity that was present, on the courage-inciting principle that it is the part of wisdom "to know the worst, and then provide for it;" but the minority was so vehement in its opposition to this view that the majority, for the sake of harmony, gave way to it, and the volume appeared with most of its statements based on the figures of 1860, those of a condition of affairs in Virginia almost entirely unlike those of 1870 the facts of which were omited, "By order of the Board of Immigration," as a foot note to page 65 of The Summary states.

The census of 1880 has been taken and a compendium of it published and now the author of "Hotchkiss' Summary of Virginia" proposes to publish in *The Virginias* the facts of 1860 and 1870 as he would have published them in 1875, adding to them, in similar form, the facts of the census of 1880, thus presenting in one view the statistics of *Three Decades of the growth of Virginia on the territory it now occupies.* The statistics of 1860 are those of the natural grand divisions of Virginia when at the height of their prosperity *before* the Great Civil war; those of 1870 present the facts of their well-nigh exhausted condition soon after emerging from that terrible struggle in which a large portion of the state was made waste and unproductive; while those of 1880 picture the state fully recovered—by the aid of her own resources, and mainly by the inherent energy of her own sons—from the disasters of the past and starting upon a career of productive development such as no previous period of her history can exhibit.

Virginia is naturally divided into six grand divisions which differ, essentially, in altitude, soil, climate, productions and general adaptations; consequently an intelligent and instructive presentation of its statistics demands that they shall be given separately for each of these grand divisions, as they are in this article.

We have not room here for a detailed description of these several divisions; for that the reader is refered to Hotchkiss' Summary of Virginia, or to Hotchkiss' special Geography of Virginia in the Virginia edition of the Eclectic Geography, and to the volumes of *The Virginias.*

These grand divisions, as here considered, taken in order from the Atlantic to the northwest, are:

1. *Tidewater* is the Tertiary marine plain that extends from the Atlantic and Chesapeake bay to the head of the tidal rivers, which penetrate nearly every part of it; it is divided into 30 counties.

2. *Midland* is the undulating Eozoic and Mesozoic plain that extends from Tidewater to the Coast Range of hills and mountains; it is divided into 25 counties.

3. *Piedmont* is the greatly varied valley-hill-and-mountain country embraced between the broken Coast Range and the Blue Ridge mountains; it is divided into 14 counties.

4. The Blue Ridge as a grand division is the three counties of Floyd, Carroll and Grayson that, with an area of 1,230 square miles, occupy a plateau on the summit of the Blue Ridge.

5. The Valley is the great limestone plateau-like belt that lies between the Blue Ridge and the Great North mountain of the Apalachians; it is divided into 15 counties.

6. *Apalachia* is the parallel valley and mountain region occupied by Virginia's portion of the Apalachian mountains,—it embraces all her territory beyond the Great Valley, although 3 of its counties, Wise, Dickenson and Buchanan, should be described as Trans-Apalachian; it is divided into 12 counties.

The area of Virginia has never been accurately determined because there has never been made a reliable actual survey of the boundaries of the state to furnish the data for calculating its extent. On pages 10 and 162 of vol. ii of *The Virginias* the facts of its area are given in full.—In the following table the areas of the grand divisions are given in square miles, in the first column that of both land and water, as we have carefully calculated them, and in the second that of land only, as they are presented in the census of 1880, which gives *land* areas only for the counties, excluding 2,325 square miles for water areas, which added to the 40,125 of land makes the Census area of Virginia 42,450 square miles; to Tidewater it gives 1,780 square miles of water surface, making its area 9,975 square miles:

	Sq. Miles, Hotchkiss.	Sq. Miles, Census.	45ths of Va.
Tidewater	10,850	8,195	11
Midland	12,470	10,650	12
Piedmont	6,680	6,830	7
Blue Ridge	1,230	1,320	1
The Valley	7,550	7,380	8
Apalachia	5,720	5,750	6
Virginia	44,500	40,125	45

The population of each grand division and of Virginia, at each census of the three decades, was as follows:

	1860.	1870.	1880.
Tidewater	344,872	346,305	421,316
Midland	371,055	363,932	444,298
Piedmont	209,732	207,204	251,764
Blue Ridge	24,500	28,558	39,646
The Valley	194,290	197,967	211,126
Apalachia	75,801	81,197	105,406
Virginia	1,219,630	1,225,163	1,512 565

The gain in Tidewater from 1860 to 1870 was less than half of one per cent; from 1870 to 1880 it was over 21 per cent.—Midland lost about 2 per cent of its population between 1860 and 1870, but gained over 22 per cent between 1870 and 1880.—Piedmont lost nearly one per cent of its population between 1860 and 1870, but gained over 21 per cent between 1870 and 1880.—Blue Ridge added over 16 per cent to its population between 1860 and 1870, and about 39 per cent between 1870 and 1880.—The Valley gained nearly 2 per cent in population between 1860 and 1870, and nearly 7 per cent between 1870 and 1880.—Apalachia gained over 7 per cent in people between 1860 and 1870, and nearly 30 per cent between 1870 and 1880.

The gain in the population of Virginia as a whole was less than one-half of one per cent between 1860 and 1870, but over 23 per cent between 1870 and 1880.—The losses and gains of the grand divisions in 1870 were largely the result of migrations of negroes, during and after the war; many of them moved to the large towns and cities and from the more devastated counties of Piedmont and Midland to the more prospering ones of The Valley and Apalachia, where labor was more in demand.

The density of the population, or the number of people to a square mile of surface, in each grand division and in Virginia, at each census of the three decades, was as follows:

	1860.	1870.	1880.
Tidewater	31.69	31.91	38.74
Midland	29.75	29.18	35.63
Piedmont	31.31	31.02	37.69
Blue Ridge	19.92	23.22	32.23
The Valley	25.73	26.22	33.18
Apalachia	13.26	94.19	18.43
Virginia	24.41	27.53	33.98

The census gives the density of the population of Virginia in 1880 as 37.7 to the square mile; a result obtained by making its area but 40,125 square miles. The density in Virginia at each census of the United States, as given in the reports, was:

1790..... 11.5	1820..... 16.4	1850..... 21.9
1800..... 13.6	1830..... 18.7	1860..... 24.6
1810..... 15.0	1840..... 19.1	1870 ..... 30.5
		1880..... 37.7

In 1880 the density of population was 128.5 per square mile in Conn., 74.8 in Del., 55.0 in Ill., 55.1 in Ind., 41.2 in Ky., 94.8 in Md., 221.8 in Mass., 151.7 in N. J., 106.7 in N. Y., 78.6 in Ohio, and 95.2 in Penn.

(To be continued.)

Victoria furnace, Goshen, Va., on Chesapeake & Ohio Ry., is working admirably, increasing its daily output, which is over 100 tons, and making a pig that gives great satisfaction to the puddlers and others that are using it, as we know from information directly from the consumers of it.—Of the tests of this pig iron, published in our last issue, the *Iron Age*, of New York, says: "The figures given are very satisfactory and well calculated to favorably impress the trade with the good qualities of the iron."

We had the pleasure of meeting Messrs Peploe, Edwardes and Boycott, of the English directory of this company, on their recent visit to this fine furnace, and of learning from them that their company is pleased with its large venture in Virginia and that it contemplates adding to it, by an increased plant, at an early day.

The Virginia Fairs will be held as follows: Abingdon, Sept. 26, 27 and 28; Wytheville, Oct. 3, 4 and 5; Pulaski, Oct 10, 11 and 12; Roanoke, October 16, 17, 18 and 19; Scottsville, Oct. 17, 18 and 19; Winchester, Oct. 17, 18, 19 and 20; Lynchburg, Oct. 24, 25 and 26; Staunton, Oct. 24, 25 and 26; Richmond, Oct. 31, Nov. 1 and 2; Botetourt Oct. 30, 31 and Nov. 1; Lexington, Oct. 17, 18 and 19. The Bristol, Culpeper and Loudoun fairs have been held.

The St. Lawrence Boom & Mfg. Co., Ronceverte, W. Va., on line of Ches. & Ohio Ry., recently sold 2,500,000 feet of lumber to a Baltimore firm, realizing some $40,000 for it.—We are pleased to know that this energetic and enterprising company is prospering in its lumbering operations; it owns large bodies of white pine and other excelent timbers on the head-waters of the Greenbrier and has superior facilities for filling large orders.

Am. Institute of Mining Engs.—The program for the Troy N. Y. meeting, Oct. 9–12, 1883, is an attractive one. R. W. Hunt, President of the Institute, is chairman, and Henry Borden, secretary of the local committee of arrangements.—Ten papers are already announced, among them, one on "Pyrites of Louisa county, Va."; by W. H. Adams of New York.

Steel nails are much smoother than iron ones, are lighter in color, stronger, less liable to bend, and yet can be greatly bent without fracture, and more readily driven into hard wood.

Metal and Mineral Traffic of Norfolk & Western Ry.—In our May No., page 82, we published the eastward bound metal and mineral of the Norfolk & Western RR. for Jan., Feb., and March, the 1st quarter of this year; Auditor E. E. Portlock has now kindly furnished us the figures in 2,000 lbs tons, for April, May and June, the 2nd quarter; so we present below the quantity of each item of this traffic shiped eastward in the first and second quarters and in the first half of this year.—The second quarter shows a gain of 7,668 tons, or over 57 per cent, on the first in the movement.

Tons of metals and minerals moved *eastward* in 1883:

	1st Qr.	2nd Qr.	6 mos.
Cement and lime	308	515	823
Shot and lead	6	7	13
Barytes	185	319	504
Manganese	100	13	113
Iron ore	2,682	8,791	11,473
Limestone		104	104
Copper, etc., ore	145	41	186
Copper ingots	73	118	191
Zinc spelter	222	246	468
Coal	2,108	2,572	4,680
Pig iron	5,342	6,141	11,483
Pig lead	3	86	89
Marble	738	821	1,549
Plaster	750	600	1,350
Salt	179	348	527
Slate and stone	115	263	378
Totals	13,307	20,985	34,292

Of the movement of the 2nd quarter there came from beyond Bristol, 1 ton of shot and lead, 3 of manganese, 8,169 of iron ore, 25 of copper and other ores, 80 of copper ingots, 23 of spelter, 1,360 of coal, 949 of pig iron, 809 of marble and 2 of slate and stone; a total of 11,421 tons, or over half of the traffic.—The iron ore was from the Cranberry mine, beyond Bristol; it was all delivered to Shen. Val. Ry. and taken to Bessemer works in Pennsylvania. The other iron ore moved was 335 tons to the Lynchburg furnace, 294 from mines near Blue Ridge station and 33 from one near Central.—The cement and lime were mainly from points on Shen. Val. and Richmond & Alleghany railways in Va, where manufactured, and from Petersburg, etc. to way stations.—The Barytes came from mines near Marion and Lynchburg and went to Boston, New York, Philadelphia, and Norfolk.—Of the manganese 3 tons were from beyond Bristol and 10 from Lynchburg, destined to Boston and New York.—The limestone was mainly from Blue Ridge and Bonsack stations, Valley limestone, to Lynchburg furnace.—The copper ore is credited to Marion, Lynchburg, Petersburg and beyond Bristol; it went to Boston, New York and Baltimore.—The ingot copper was from Marion (from N. C. furnaces) and from beyond Bristol, all destined to New York.—Of zinc spelter the shipments were mainly from Martin, Va., from Bertha Zinc works, to New York and Philadelphia; 23 tons were from beyond Bristol.—The coal shipments were 1,360tons from beyond Bristol, Tenn.coal, 10 from Dublin, and 10 from Christiansburg, No. X coal from Brushy mountain, and 1,187 from the Flat-top mines at Pocahontas, the begining of the great traffic in that Lower measures semi-bituminous coal; the shipments were to way stations and 301 tons to Norfolk. Of the pig iron 949tons were from beyond Bristol, 683 from Lynchburg, probably from the furnace there, and the rest from Crockett, Max Meadows, Dublin, New River, Rural Retreat and Martin stations, from the charcoal furnaces of Wythe and Pulaski counties; except 36 tons from Roanoke and 3 from Petersburg; its destinations were to Boston, New York, Philadelphia, Baltimere, Petersburg, Norfolk, Richmond, the Shen. Valley RR., etc.—The pig lead was from Max Meadows, from Wythe Co. lead works, to Boston, New York and Baltimore.—The marble was nearly all Tenn. marble, from beyond Bristol, to Atlantic cities.—The plaster and salt were nearly all from Saltville, Va., to way stations, but some foreign plaster and salt were moved.—The slate and stone were moved chiefly from Saltville, Blue Ridge, Lynchburg, Petersburg, Shen. Val. RR., Ingleside and Ripplemead to way stations and Norfolk.

The tons of metals and minerals moved *westward* during the 2nd quarter of 1883 were as follows:

Cement and lime	1,201	Pig iron	90
Shot and lead	4	Marble	25
Barytes	132	Plaster	1,265
Iron ore	4,924	Salt	2,320
Limestone	1,658	Slate and stone	1,259
Coal	4,650	Coke	40
		Total	17,574

By the above it appears that the westward movement for the 2nd quarter of 1883 was but 3,411 tons less than the eastward; the entire movement for the quarter was 38,559 tons. We failed to get the figures for the 1st quarter.

Of this westward movement the cement and lime came mainly from Norfolk, City Point, Suffolk and Lynchburg, destined to stations on the railway; much of it probably was made in other states, though part of it was possibly oyster-shell lime from tidewater points and part of it from points in the Valley.—The barytes was sent from Marion and seven-mile Ford to the South and Southwest.—The iron ore and limestone were all from Blue Ridge station to Roanoke, for the Crozer furnace most likely.—Of the coal, 4,132 tons were sent from Martin station, No. X coal from the Altoona mines, probably to Saltville, where that coal, mainly in the form of "slack," is used in the manufacture of salt; 70 tons of Flat-top coal went westward.—The pig iron was from Lynchburg, Crockett and Shen. Val. Ry. to the southwest.—From Saltville 618 tons of plaster and 1,428 of salt were sent to points on the railway and to the South and Southwest; the rest of these articles were sent from Norfolk, Petersburg, Lynchburg, etc. to points on the railway and beyond; imported salt and plaster.—The slate and stone were movements of granite, etc., from Petersburg, Richmond, etc., to towns on the railway.

Average value of fuels.—In a practical treatise on boilers and their use, by Prof. Chas. A. Smith, now in course of publication by the "American Engineer" of Chicago (a journal of great excellence, by the way) a table is given of "variations in the quality of fuel," or in their evaporative power. Below are some of these average and comparative values of *best* samples of fuel.

Pure carbon	15.	Dry bituminous coal	15.9
Dry charcoal	14.	Coking do. do.	16.
Good dry coke	14.	Dry pitch pine	10.
Anthracite coal	15.3	Mineral oils, about	22.6
Dry peat	10.	Illinois coal	12.

The rank of bituminous coals in this comparison is worth the attention of all consumers of coal for steam producing.

Prof. Smith also states that the refuse from the best soft coals is from 3 to 10 per cent, from Illinois coal and from anthracite 10 to 20. The soft coals lead in value.

Coal and Coke Traffic, Ches. & Ohio Ry., Aug. 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during Aug., 1883, and Aug., 1882, in tons of 2000 lbs., compiled by fuel agent, C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	1,770	4,004	....	2,234
Gas	20,535	30,831	....	10,356
Splint and block	9,671	8,082	1,589	....
New River, &c	30,452	33,362	....	2,910
Coke	7,001	7,791	....	790
Totals	69,429	84,130	1,589	16,290

This movement for August, 1883, shows net decrease of 14,701 tons compared with the movement for August, 1882; a decrease shared in by all the kinds of fuel transported except splint and block coals.

The distribution of the above was as follows:

	1883.	1882.
1. To Ches. & Ohio Co. for its own use	12,687	14,112
2. To Huntington, for West via Ohio river	830	2,160
3. On Elizabethtown, Lexington & Big Sandy RR	2,406	4,331
4. On Ches. & Ohio Ry., excepting Richmond.	16,164	4,507
5. To Richmond & Alleghany RR. at Clifton Forge.	207	73
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	26
7. To Shenandoah Valley RR. at Waynesboro	16	2,088
8. To Va. Midland Ry. At Charlottesville	3,194	4,769
8. To Va. Midland Ry. At Gordonsville	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR Junc.	108	135
10. To Richmond for consumption, including tugs, &c	5,522	3,706
11. To James River wharves for shipment	12,534	19,336
12 To Newport News Consump'n includ'g tugs &c,	270	4,291
12 To Newport News For shipment	15,521	24,596
Totals	69,429	84,130

This shows a very large increase in the deliveries of coal on the line of this railway west of Richmond, a consequence of the great activity in the manufacture of iron now prevailing along this railway.

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	19,704	21,225	.....	1,521
Gas	249,554	217,714	31,840	.....
Splint and block	67,567	86,237	.....	18,670
New River, &c	270,236	232,198	38,038	.....
Coke	70,961	60,026	10,935	.....
Totals	678,022	617,400	80,813	20,191

This shows a net increase of 60,622 tons, or about 10 per cent, in the yearly movement of 1883 over that for 1882 up to August 31st.

A new Railway and Blast-furnace in W. Va.—There are two important enterprises about ready to be set in operation, which, from the quiet and successful manner in which they have been managed, have failed to receive that public notice they deserve. We refer to the Kanawha and Coal River Railroad, and the Black Band Iron and Coal Company. These companies have for their local basis, 3,500 acres of valuable coal, iron and timber lands on Davis creek, and 500 acres of land suitable for a town site and manufacturing purposes, on the Kanawha river, at the mouth of Davis creek. A blast furnace has just been completed at the mouth of Davis creek, which is now fully stocked and ready for the fire. This furnace is of 30 tons capacity per day, and is but one of many other iron enterprises contemplated by these companies.

A standard gauge railroad has been completed up Davis creek 15 miles to the company's lands. Engines and cars are being built for this road of sufficient tonnage to do a large amount of business. In a word, the road will be fully stocked in a very short time. The charter held by the Kanawha and Coal River RR. Co. extends to Coal river.

The Black Band Iron and Coal Company's lands are perhaps the most valuable of any lands embracing the same number of acres, in this part of West Virginia; and, considering their three-fold value—coal, iron and timber—it is questionable if a similar body of lands can be found anywhere.

The main seam of iron ore is the black band, although there are other varieties in great quantities. The coal is of a superior quality. Experiments have been made in Boston with what is known as Block coal, taken from these lands, which resulted in demonstrating the fact that its equal for gas purposes, never went to that market. It is from this coal that coke is to be made. Some $600,000 have been expended by these companies in purchasing the land, making the railroad, building the furnace and making other improvements, and as we have already intimated, little has been said about it, although employment has been given to our leborers and mechanics, and a great part of this vast sum of money paid out in our county.

The credit of securing these important enterprises to Kanawha is due to James H. Huling and Capt. W. M. Hovey, who have worked with commendable energy, although at times under discouraging circumstances.—*Weekly Leader*, Charleston, W. Va., Sept. 13, 1883.

Meteoric Iron.—In Silliman's American Journal, 1866, there is an account of a mass of meteoric iron which some one saw about 15 years previously, in Botetourt county, Va., and left on a stone wall by the side of a public road. A fragment of this meteorite was analyzed by Woehler, of Goettingen, who found in it over 20 per cent of nickel. It was whiter than most iron, very close and homogeneous in structure, with a few minute pyritic grains. Its specific gravity was 7.64; its fracture fine granular, like cut steel; is not prone to decompose, and does not give Widmannstætian figures.—Who will find this valuable meteorite for the cabinet of the University?

Natural gas from bored wells is making quite an inroad on the consumption of coal; a window-glass works at Wellsburg, W. Va., states its superintendent, now uses but 30 bushels of coal a day in connection with gas, while formerly it used 380, thus reducing its expenses from $39 a day to $7.

The gas well at the Central Glass-works, Wheeling, W. Va., says the "Intelligencer" is now 1,230' deep; the gas from it makes a strong, steady blaze several feet high.

Hardness of Coke.—Our friends in discussing the comparative merits of different cokes make some very nice discriminations as to hardness; commenting on these in a general letter, Dr. Froehling says: "I have never yet been able to differentiate between a hardness of 3.15 and 3.20, except by guessing at it, which I don't do. The Hawks Nest coke seems to be the hardest, it is nearly or quite 4, while Low Moor is somewhat below 3.5; Longdale, and Fire Creek are between these figures."—In this connection, speaking of "nice calculations," we recently heard that a foundryman in charge of a large Virginia blast-furnace, now using mainly W. Va. coke, but who had been "raised" on Connellsville coke, says he finds in practice that Connellsville coke is *about five* per cent better than New River, West Virginia coke.

Analysis of Flat-top Coke.—It was stated in our last issue that the coke ovens of the Southwest Virginia Improvement Co., at Pocahontas, Va., on Norfolk & Western RR., were in full and successful operation, producing a satisfactory coke, one that the founder at Crozer furnace, Roanoke, Va., who had been using both cokes in the same furnace, said gave as good results in his blast-furnace practice as Connellsville. Below we give a complete analysis of this Pocahontas coke, made from the coal of the No. 3 or big bed of the Flat-top section of the No. XII or Lower Measures Virginia coals, kindly made for *The Virginias* by Dr. Henry Froehling, Analytical and Consulting Chemist of 17 South 12th St., Richmond, Va.

This coke was sampled by Mr. W. A. Lathrop, Supt. of mines, etc , of S. W. Va. Improvement Co.; we requested him to make it represent a fair average of the product of the ovens.—The sample analyzed represents an average of the charge of a 12 x 6 beehive oven coked 72 hours; it was drawn August 16, 1883.

For comparison, we place alongside Dr. Froehling's analysis of the Flat top coke the analysis, by Mr. McCreath, of the "typical Connellsville coke," that Mr. Fulton selected for his comparison of Pa. and W. Va. cokes. (See page 40 of this volume.)

	Flat-top.	Connellsville.
Fixed carbon	93 84	89.576
Volatile combustible matter	0.59	0.460
Moisture	0.29	0.030
Ash	5.28	9.113
	100.00	99.179
Sulphur	0.357	0.821
Phosphorus	0.018	0.014

In the ash of the above analysis of Flat-top coke, Dr. Froehling found the following ingredients:

Silica	2.780	Phosphoric acid	0.018
Alumina	1.009	Sulphuric acid	0.158
Ferric oxide	0.881	Potash	0.068
Lime	0.341	Manganese	a trace.
Magnesia	0.016	Total	5.271

It is instructive to repeat in this connection Chemist Andrew S. McCreath's analysis of the coal, from the mines of the S. W. Va. Improvement Co., from which this coke was made. Mr. McCreath sampled complete sections of 11' 8" of the thickness of the big bed at five different points in the mine. He says: "These different samples were crushed and intimately mixed previous to analysis, and they should fairly represent the character of the coal obtained in mining operations."—This analysis showed this coal to contain:

Water	0.932	100.00
Volatile matter	20.738	
Fixed carbon	73.728	
Sulphur	0.618	
Ash	3.984	
Phosphorus	0.0013	

Mr. McCreath states, under date of March, 1883: "Although none of this coal has as yet been coked in ovens, laboratory experiments and tests in pits indicate that an excellent quality of coke can be made from it, containing not over five per cent of ash, and with an open cellular structure combined with great strength;" characteristics that the above analysis and the test of use in the Crozer furnace confirm.

We have heretofore called attention to some experiments that were made by Edward I. H. Howell, M. E. of Philadelphia, at the instance of the President of the S. W. Va. Improvement Co., to test the *value of coke as compared with anthracite coal* as fuel for domestic purposes, but now that Flat-top and New River cokes, made from Virginia and West Virginia coals, are to be had in abundance, we reproduce these reliable experiments for the information and guidance of our fuel consumers.

"To the President of South-west Virginia Improvement Company:—I would respectfully submit the following report of the result of tests made to determine the value of coke for domestic use as compared with the best anthracite coal. The tests extended over two weeks, and were conducted with all due care, in the following manner:

A record was made at regular intervals of the temperature of houee, cellar, air-chamber of heater, water (in water heater), and of escaping gases in smoke-pipe. All temperatures under control were kept close to fixed points, and the variation in temperature of outer air was duly noted and allowance made in calculation of results.

It was evident that fuels varying so greatly in character as coal and coke could not be burned to the best advantage in the same manner; care was therefore taken to note all the results obtained in burning coke under the different conditions, and in the various manners, and from the data so obtained the following report is compiled; the test was made by burning (under conditions named) coal and coke, alternately, in various heaters, stoves, etc., as follows:

1st. Morris, Tasker & Co —Hot water heater; grate flat.
2d. Medium base burner; self-feeding stove, circular fire-pot and grate.
3d. Medium-sized hot-air heater; circular fire-pot and grate.
4th. Small-sized hot-air heater; circular fire-pot and grate.
5th. Medium-sized kitchen range.
6th. Green-house water heater; flat grate.
7th. Low-down grate.

Test No. 1. Morris, Tasker & Co's water heater.—General conditions.—Water kept 160°. Fires run with doors open; all draft off. Test started and closed with coke at a fixed depth in grate; records taken every two hours, except during night, when fires were banked.

Coke test.

54½ hours run with coke, amount burned	736.5	pounds.
Ashes, total	93.	"
Average consumption in 24 hours	324.	"
Average ashes per 100 pounds coke	12.6	"

Coal test.

54 hours run with coal, amount burned	948.5	pounds.
Ashes	124.25	"
Average consumption of coal in 24 hours	420.	"
Average ashes per 100 pounds of coal	13.1	"
Percentage of coal burned in excess of coke,	30	*per cent.*

Test No. 2. Base burner.—General conditions.—Draft kept same, and fire at cherry red. Checked at night—draft all off.

Coke test.

In 53 hours run, amount burned	163.	pounds.
Average consumption in 24 hours	73.8	"
Ashes per 100 pounds coke	18.	"

Coal test.

In 50 hours run, amount burned	177.	pounds.
Average consumption in 24 hours	84 9	"
Ashes per 100 pounds	17.5	"
Percentage of coal burned in excess of coke,	15	*per cent.*

Test No. 3. Medium heater.—Conditions same as No. 2.

Coke test.

72 hours run with coke, amount burned	178.	pounds.
Average consumption in 24 hours	59.3	"

Coal test.

72 hours run, amount burned	205.	pounds.
Average consumption in 24 hours	68.3	"
Percentage of coal burned in excess of coke,	15	*per cent.*

Test No. 4. Small heater.—Conditions same as No. 3.

Coke test.

48 hours run with coke, amount burned.....	54.	pounds.
Average consumption in 24 hours	27.	"

Coal test.

48 hours run with coal, amount burned	68.	pounds.
Average consumption in 24 hours.....	34.	"
*Peecentage of coal burned in excess of coke,....	25	*per cent.*

Test No. 5. Kitchen range.—Test both for economy and efficiency.

48 hours run with coke, amount burned.....	154.	pounds.
Average consumption in 24 hours.....	77.	"
48 hours run with coal, amount burned.....	174.5	"
Average amount in 24 hours.....	87.25	"
Percentage of coal burned in excess of coke,	13	*per cent*

Test No. 6 was made to ascertain the capability of coke for holding fire for long periods, without attention in interval, and result will be stated in general suming up.

Test No. 7 was made to ascertain in what manner coke could be used for grates, and method of burning to best advantage.

Conclusions from tests.—From the above tests the following general results may be considered as demonstrated:

1st. That coke can be successfully and economically used for all domestic purposes.

2nd. That under proper conditions and with proper care, the coke is more economical than anthracite coal.

Conditions and care required for economical use of coke.—As the relative value of anthracite to coke (based on the amount of carbon) may be expressed as 10 to 9, we must look for a reason for the greater economy of coke, as shown by tests. This will be found in the *bulk* of *coke* as compared with anthracite. A cubic foot of anthracite will weigh from 53 to 56 pounds, while the same amount of coke will be but 27 to 30 pounds. For practical purposes we may call the bulk of coke double that of coal for same weight.

This greater bulk enables the grates of heaters, stoves, etc. to be covered with a fuel weighing half that of the same amount of coal, and prevents, to a great degree, the waste from the insane desire of all domestics to fill the heater or range full of coal. Added to this, *coke will burn longer*, hold a *steadier heat than anthracite*, when it is used in deep or broad fires, and all drafts shut off. Hence, when care is taken on above points, a remarkable economy as compared with coal will result, and the *greatest per cent of saving will be in the largest grates.*

The result in Test No. 1 may be considered as above the average to be expected, but certainly a saving in cases refered to, of 20 per cent may be expected

In smaller grates, a lower percentage will be made, and the result in Tests 2 and 3, which resulted in same average of saving, may be taken as a fair estimate, *i. e.*, 15 per cent.

From the tests made, the following facts may be stated as demonstrated for the successful burning of coke:

1st. The size of coke used should be a size smaller than that of anthracite for same purposes

2nd. Fire should be made deep and broad, and after coke catches, all drafts should be checked (at night entirely, in most cases). Care must always be taken to keep supply of coke large, as fire will not be held except in deep bodies of coke.

3rd. The most strongly marked peculiarity of coke is indicated in above directions; *i e.*, the absolute need of a body or quantity of it. It cannot be burned in shallow fires.

4th. The ashes from coke are a white powder and free from clinker.

In conclusion, I should say that for domestic use and weight for weight with anthracite, it will be found, in most cases, to give better and more satisfactory results.

Very Respectfully,
Edward I. H. Howell, M. E.

Sales Agent of S. W. Va. Improvement Co., E. S. Hutchinson, of 138 S. 3rd. St., Philadelphia, says:—This report shows that Flat-top coke as a fuel for household purposes has a value from fifteen to thirty per cent over the best anthracite coal, so that coke at $4 per ton, at which price it can be sold at Lynchburg and all points west, is as cheap as anthracite coal at $3.50 per ton.

At Norfolk, Petersburg, and all places where coke can be placed at a cost of not exceeding $5 per ton, the best Lehigh anthracite coal would have to be sold at $4 per ton to equal it in value as a domestic fuel.

But it has other advantages over anthracite coal for cooking purposes, as the fire can be kindled in much less time and at a less expenditure of fuel; and for such purposes as broiling, it is as good as a charcoal fire.

Remember this also: Coke burns with a bright glow, has no dust, and the smallest per cent of ash of any fuel used.

Crushed Coke is now regularly quoted, especially in eastern cities where it has taken the place of anthracite for domestic purposes. We notice in one of our recent exchanges that Connellsville coke in Chicago is quoted at $5.15 to $5.20 per ton, and crushed coke at $6.05 to $6.20 per ton, according to delivery.—We hope that some of our coke manufacturers will soon give us crushed coke in Virginia to take the place of the large quantities of Pa. anthracite that are now consumed here.

"Coal" of New York, states that during the present year coke has made startling inroads into the foundry trade of anthracite coal in the eastern and middle states, where formerly the best grades of Lehigh lump were used to melt iron in cupolas for machinery and stove castings. Connellsville and other cokes are so extensively used that not more than one-quarter or one-fifth of the quantity of anthracite used years ago is now consumed.

The tubulitic strata of No. V, which are described, on page 13 of this volume, by Prof. Wm. B. Rogers, as unique features of the upper beds of formation No. V, the Clinton, are remarkably well presented in the cut that Capt W. N. Page has had made in the N. E. end of Brushy mountain, near the Rockbridge Alum Springs, Va., for mining Clinton or red-shale ore for the Victoria furnace. The coloring of the tubulites in some of these sand-rocks brought to the furnace is very beautiful. It would be well for all our geologists to become familiar with the appearance of these strata, as they are useful guides in seeking for the Clinton ores.

Flat-top Coal and Coke.—On another page we give an analysis of the first-class coke now being made at Pocahontas, Tazewell county, Va., from Flat-top (New River) coal by the S. W. Va. Improvement Co. Supt. W. A. Lothrop furnishes us, under date of Sept. 15, 1883, the following facts of the output, etc, of the S. W. Va. I. Co. from the opening of the New River branch of N. & W. Ry. to its mines in May last to date:

Coke shiped	34,872 tons.
Coal coked	10,140 "
Total output,.....	45.012 "
Coke made	6,084 "

Percentage of coke from coal 60.

Evidences of a great ancient Glacial Lake in West Virginia.

By Prof. I. C. White.

Among the papers read before the geological section at the recent meeting, at Minneapolis, of the American Association for the Advancement of Science, was the following deeply interesting and thoughtful one, by Prof. I. C. White, of the University of W. Va., on the old *Glacial Dam* at Cincinnati and the evidences of the West Virginia portion of the vast lake made by that dam.

"In a paper read before the Boston Society of Natural History, March 7, 1883, Rev. G. F. Wright has shown that the southern rim of the great northern ice sheet, crossed the Ohio river near the site of New Richmond, a few miles above Cincinnati. Mr. Wright believes that one effect of this invasion of the Ohio valley by the glacial ice, was to form an immense dam of ice and morainic debris 500 or 600 feet high, which effectually closed the old channel way, and set back the water of the Ohio and its tributaries until rising to the level of the Licking river divide, it probably found an outlet through Kentucky around the glacial dam. As this divide is 500 or 600 feet higher than the present bed of the Ohio at Cincinnati, Mr. Wright states that the site of Pittsburg would have been submerged to the depth of 300 feet, and adds: "It remains to be seen how much light this may shed upon the terraces which mark the Ohio and its tributaries in Western Pennsylvania."

Having resided for nearly a score of years in the valley of the Monongahela river, the writer is necessarily familiar with its terraces and surface deposits in general; and in reply to the above query of the eminent glacialist, would answer that his admirable work throws a flood of light upon the Monongahela terraces, and proffers for them and the deposits along other tributaries of the Ohio, the only satisfactory explanation that has ever been advanced.

Of course, if the Ohio river was ever so obstructed for any considerable period of time, it would follow, as a necessary result, that many of the tributary streams and the Ohio itself above the limit of the dam, would have their old valleys silted up with vast heaps of trash—clay, sand, gravel, boulders, drifted logs and other rubbish—carried down by the streams from the region not sheeted with ice, and dumped into the great inland lake stream which extended from Cincinnati far up toward the sources of the Monongahela.

That the valley of the latter stream has been refilled with trash during some period of its history to a height of 250 or 300 feet above its present bed, the evidence is most conclusive, for the remnants of this deposit still cover the surface to a great depth in long lines of terraces extending from Pittsburg, Pa., southward along the river to Fairmont, W. Va. a distance of 130 miles, and very probably much further, as I have never examined the river valley above the latter town.

The striking peculiarity of these terrace deposits is that they suddenly disappear at an elevation of 1050 or 1075 feet above tide, not a single rounded and transported boulder ever being found above the latter horizon, though occuring in countless numbers below this level.

The hills along the river often rise 300 or 400 feet higher than the uper limit of the deposits, so that there can be no mistake about the elevation at which the terrace deposits disappear. The composition of these great heaps of surface debris is, along the immediate valley of the river, a heterogeneous mixture of sand, clay, gravel, rounded boulders of sandstone of every size, from an inch in diameter up to four feet, pieces of coal, leaves, logs of wood, and every other species of rubbish usually transported by streams. Back from the channel of the river, however, and especially where the surface configuration would make quiet water, there occur thick deposits of very fine, bluish white clay, in which great numbers of leaves are most beautifully preserved. These clays have been extensively used for the manufacture of pottery at Geneva and Greensboro, Pa., and also to some extent at Morgantown and Fairmont, W. Va. Though the clay deposits occur at nearly every horizon they are purest near the uper limit of the terraces, and these are consequently the only ones that have hitherto been much explored.

In the vicinity of Morgantown, terraces of transported material occur at the following approximate (measured by barometer) elevations:

	Ft. above river.	Ft above tide.
First terrace	30	820
Second terrace	75	865
Third terrace	175	965
Fourth terrace	200	990
Fifth terrace	275	1065

The accompanying cross section of the Monongahela valley, near Morgantown, exhibits the relations of the terrace deposits to each other and to the river channel.

The first terrace is the present flood plain of the river, consisting principally of fine sand, mud and gravel. It seems to possess some respectable antiquity, however, since Mr. Walter Hough, one of my students, dug some teeth and bones from five feet below its top, which were identified by Prof. O. C. Marsh, as the remains of a species of peccary, an animal that has not inhabited the region in question within the American historic epoch.

All of the other terraces have thick deposits of transported material wherever the original contour of the surface has favored its preservation from erosion. From the top of the fourth terrace Mr. Keck dug a well through 70 feet of clay, gravel and boulders without finding bed rock. He also encountered logs of wood in a soft or semi-roten condition near the bottom.

Many other wells on the third terrace have been sunk to depths of 20 and 30 feet without reaching bed rock.

The fifth terrace of this Morgantown series marks the height to which the pre-glacial valley of the Monongahela was silted up, partially or entirely during the existence of the glacial dam at Cincinnati, since, as already stated, no clay beds, rounded boulders or other transported material are ever found above its top, but instead only angular fragments of the country rock, and thin coverings of surface material which has accumulated *in situ*.

Owing to the considerable elevation—275 feet—of the fifth terrace above the present river bed, its deposits are frequently found far inland from the Monongahela, on tributary streams. A very extensive deposit of this kind occurs on a tributary one mile and a half northeast of Morgantown, and the region, which includes three or four square miles, is significantly known as the "flats." The elevation of the "flats" is 275 feet above the river or 1065 feet above tide. The deposits on this area consist almost entirely of clays and fine sandy material, there being very few boulders intermingled. The depth of the deposit is unknown, since a well sunk on the land of Mr. Baker passed through alternate beds of clay, fine sand and mudy trash to a depth of 65 feet without reaching bed rock. In some portions of the clays which make up this deposit, the leaves of our common forest trees are found most beautifully preserved. Whether or not they show any variations from the species growing in that region, the writer has not yet had time to determine, but when a larger collection has been obtained, this subject will receive the attention that it deserves, since if the date of the glacial

epoch be very remote, the species must necessarily show some divergence from the present flora.

Of animal remains the only fragment yet discovered in this highest of the terraces is the tooth of a mastodon, dug up near Stewartstown, seven miles northeast from Morgantown.

The other tributaries of the Monongahela, on which the writer has noted the clay and other deposits of the fifth terrace, are Decker, Dunkard, Whitely, Mudy, and Ten Mile creeks, and in each case the deposits disappear at the same absolute level at which they cease along the river.

The Great Kanawha river, another principal tributary of the Ohio, draining a region that was never glaciated, also exhibits water-worn boulder deposits which disappear at 200—300 feet above the present level of that stream, though I have not determined the exact limit.

The glacial dam at Cincinnati presents a complete explanation for the origin of Teazes valley, an ancient, deserted river channel 20 miles long and one or two miles wide, which leaves the Great Kanawha 15 miles below Charleston, W. Va., at Scary, and passing through Putnam and Cabell counties, extends to the valley of Mud river, a tributary of the Guyandot which empties into the Ohio at Huntington.

This valley, although having an elevation of 200 feet or more above the Kanawha, is filled to a great depth with rounded boulders of sandstone, chert, cannel coal and other trash which has plainly been transported down the Kanawha from above Charleston, so that although it was clearly seen that the water of the Kanawha had once found an outlet to the Ohio by way of this valley and the Mud and Guyandot rivers, yet why this ancient channel should have been abandoned for the present much more circuitous one had always remained a mystery until Mr. Wright furnished the key in his discovery of the great ice dam at Cincinnati. For it is now clear that such a barrier would set back the water of the Kanawha until rising above the divide which had previously separated it from Mud river, it sent an arm across to the Ohio by way of the Guyandot, 50 miles below where the other arm and main stream reached the same river at the present mouth of the Kanawha, thus converting portions of Putnam, Mason and Cabell counties into a large triangular island, the base of which was formed by the swollen Ohio, and the sides by the two arms of the Great Kanawha. The melting away of the Cincinnati dam withdrew the water from the western or Mud-Guyandot arm of the Kanawha, leaving the abandoned valley high and dry, but littered up with transported trash as we now see it, while the Kanawha continued on to the Ohio in its present and pre-glacial outlet.

A summary view of these and other facts in the writer's possession seem to prove, beyond any reasonable doubt, that Mr. Wright's hypothesis concerning the daming up of the Ohio by the glacial ice in the region of Cincinnati was an actual reality; that during the period of its continuance the principal tributaries of the Ohio had their valleys filled with sediment carried down and dumped into them by the mountain torrents, and other streams which drained the area south from the glaciated region; that subsequently, when the barrier disappeared, the rivers recut their channels through the silt deposits, probably by spasmodic lowering of the dam, in such a manner as to leave the deposits in a series of more or less regular terraces which in favored localities subsequent erosion has failed to obliterate, though from steep slopes it has removed their every trace.

The elevation of this dam at Cincinnati, as determined from the upper limit of the fifth Monongahela river terrace, would be somewhere between 1050 feet and 1075 feet above tide, or about 625 feet above low water there in the present Ohio.

Notes on the Geology of West Virginia.

Written for *The Virginias* by Prof. I. C. White.

(Continued from page 126.)

No. VI. The geology of the Ohio River from New Martinsville to Marietta.

Form New Martinsville the Ohio river takes a course not far from S. 45° W. on which it continues to flow for nearly 30 miles, making the long, straight sweep known on the river as Long Reach. For some distance below New Martinsville, the rocks are nearly horizontal with reference to the Ohio river, so that the horizon of the *Pittsburg coal* remains nearly the same as at the latter town, viz: at 250-300 feet below the level of the Ohio river. This will be rendered plain by the following Section (11) taken in descending a steep hill on the W. Va. shore, one mile above Sistersville, Tyler Co., and nine miles below New Martinsville:

1.	Soil and *red shale* from tob of knob	15′
2.	*Deep red shale*	20′
3.	Sandstone and concealed	10′
4.	*Red marly shale*	5′
5.	Concealed	30′
6.	*Deep red, marly shale*	10′
7.	Concealed	35′
8.	*Coal, Jolleytown*, a thin streak thickness only	2″-3″
9.	Shaly limestone and fire-clay	1′
10.	Shales	5′
11.	Sandstone, massive	10′
12.	Concealed	5′
13.	*Red shale*, containing nodules of iron ore	5′
14.	Concealed	60′
15.	Sandstone, rather massive	10′
16.	Concealed and shaly sandstone	30′
17.	*Deep red shale*	15′
18.	Sandstone and sandy shale	15′
19.	*Deep red shale*	10′
20.	Sandstone	2′
21.	Marly, gray shale	10′
22.	*Red shale* with small limestone nodules at base	10′
23.	Shales and shaly sandstone	5′
24.	Sandstone, flaggy	10′
25.	Sandstone shales and concealed	35′
26.	Sandstone, rather massive	15′
27.	Concealed	5′
28.	*Coal, Washington, blossom*	—
29.	Concealed	20′
30.	Flaggy sandstone	20′
31.	Concealed to low water in Ohio river	50′
	Total	473′

248′

This hill is not high enough by about 30 feet to reach the horizon of *Limestone X*, since that stratum belongs 400′ above the *Washington coal*, while the hill rises to only 370′ above the latter.

It extends up however far enongh to catch a representation of one of the *Permian coals*, which has a wide distribution in southwestern Pa. and Monongalia, Marion and Wetzel counties of W. Va. This is No. 8 of the section, a thin streak of *coal* which seems to represent the *Jolleytown coal bed.*

In Greene Co., Pa., where this bed was first named by Prof. J. J. Stevenson, it comes 260′-275′ above the *Washington coal*, and is the first bed above the latter that ever furnishes any workable coal, since it sometimes attains a thickness of 2½ feet. It has been absent in all the sections, however, along the Ohio, between Moundsville and New Mar-

tinsville, unless a thin seam of fireclay with the slightest trace of dark slate seen in the New Martinsville section should be identified with this coal.

The section shows that the coal comes 248′ above the *Washington bed* at Sistersville, thus like all the other intervals exhibiting a slight westward decrease in thickness.

The interval from the *Jolleytown coal* to *Limestone X* in Greene Co., Pa., is 165 feet, against 155 here on the Ohio river.

The Washington coal has not been mined in the vicinity of Sistersville, as far as I could learn, so that nothing is known as to its thickness or quality there, though judging from the black streak made in the soil by its outcrop the coal cannot be more than 2½′-3′ thick.

Several small, rounded boulders were observed on the very summit of the knob where the section begins at an elevation of something like 1050 feet above tide. Since this is the only locality along the Ohio river between Wheeling and the Kentucky line where rounded boulders were observed at more than 60′-80′ above the river, I am inclined to believe that those near Sistersville were carried up from the river by the Indians, since some chiped flints, a mortar, and pestle found on the knob, prove it to have been one of their camping sites, though if Rev. G. F. Wright's theory be true that the waters of the Ohio were in Glacial times set back by a great dam of ice 500′-600′ high, which, as the terminus of the Northern Ice-sheet, crossed the Ohio valley into Kentucky above the site of Cincinnati, then these rolled boulders on the summit of the Sistersville hill could be readily accounted for, since they come at about the upper limit of the back-water which such an ice dam would make.

A wide terrace occurs at Sistersville, the top of which makes a beautiful plain 60 feet above low water.

About one-half mile below Long Reach P. O. and eight miles below Sistersville the hills rise abruptly on the Ohio side, and in descending from their summits the following Section (12) was constructed :

1. Concealed from top of knob	5′	
2. Sandstone, brownish gray	5′	
3. Concealed	10′	
4. *Red shale*	5′	
5. Sandy shale	15′	
6. Massive sandstone	10′	
7. Concealed	20′	130′
8. Red and variegated shale containing iron ore nodules	20′	
9. Concealed	15′	
10. Sandstone, massive	10′	
11. Concealed	15′	
12. Fireclay with appearance of thin *coal streak*, *Jolleytown*	½′	
13. *Red shale* and concealed	10′	
14. Sandstone, very massive, gray	20′	
15. Concealed	25′	
16. Marly shales containing small limestone nodules	10′	
17. Concealed	5′	
18. Sandy shales, and flaggy sandstone	30′	250′
19. Sandstone, massive	15′	
20. Concealed	10′	
21. Shaly sandstone and shales	25′	
22. Gray shales	35′	
23. *Red shale* with rich iron ore nodules	10′	
24. Concealed	20′	
25. *Red shale*	20′	
26. Sandstone and concealed	15′	
27. *Coal, Washington*, blossom	—	
28. *Red shale*	10′	
29. Sandstone, massive	20′	
30. Concealed	10′	
31. *Limestone*, light gray, rather pure	2′	
32. Concealed	40′	
33. Variegated shales interstratified with impure limestones	10′	150′
34. *Red shale*	15′	
35. Fireclay and shales	3′	
36. Concealed to low water in Ohio river	40′	

This section shows that the rocks have risen above river level about 60′ from the locality of the last section (near Sistersville) to this point, and consequently the horizon of the *Pittsburg coal* has approached that much nearer the surface than it was at Sistersville, and ought to be found here, if present, at a depth somewhere between 200 and 250 feet.

The *coal streak*, No. 12, seems to represent the *Jolleytown bed* because it comes at the same interval above the *Washington coal* (No. 27), as the one which was identified with the *Jolleytown coal* in the Sistersville section (11).

The Washington coal is but feebly represented in this section, since if one can determine anything from its decomposed outcrop the coal cannot be more than one foot thick, and is quite slaty besides.

At Raven Rock P. O., four miles below Long Reach, the river bluff on the W. Va. side is capped with an enormous sandstone from which the descent to the Ohio river is almost vertical for more than 300 feet. In descending from the summit of the Raven Rock cliffs the following Section (13) was obtained :

1. Sandstone, *Upper Proctor*, very massive	45′	
2. Soft gray shales	35′	
3. Flaggy sandstone	5′	
4. Sandstone, *Middle Proctor*, very massive, current-beded, micaceous	20′	
5. Shales, gray	15′	
6. *Red shale*	20′	
7. Flaggy sandstone	5′	
8. Gray shale	3′	
9. *Red shale*	2′	
10. Gray shale	2′	
11. Calcareous lean iron ore	1′2″	
12. Red and gray shales	15′	
13. *Coal and black slate, Washington*	1′	
14. Fireclay and shales	3′	
15. *Limestone*, impure, sandy	2′	
16. Sandy shales	3′	
17. Sandstone, *Lower Proctor*, massive	20′	
18. *Limestone*, light gray, good	5′	
19. Concealed	15′	
20. *Limestone*, interstratified with *red* and greenish shales	50′	176′
21. Concealed	25′	
22. *Red shale*	3′	
23. Sandstone, flaggy and massive, Waynesburg	20′	
24. Concealed to low water in Ohio river, but containing a *coal* (Waynesburg) reported 3′ thick about 10′ below top of interval	30′	
Total	345′	

Here, as will be seen from the section, the *Washington coal* has risen 25′ higher above the river than it was in the previous section, 3½ miles above, thus bringing the top of the *Upper coal group*, or No. XV, above river level, since No. 23 seems to represent the *Waynesburg sandstone*, and a *coal* is reported as occuring a short distance under it, which would be the *Waynesburg bed*, the top member of XV.

The Upper Proctor sandstone, No. 1, caps the hill at this point, and on its top lie two or three enormous loose blocks of sandstone, which must be a portion of the same bed broken up by erosion, so that the original thickness of the *Upper Proctor* stratum at this locality must have been 60'-75'. The rock is rather coarse, soft, somewhat feldspathic and of a yellowish gray color.

The scenery around these massive sandstones is very wild and picturesque, and the locality is much frequented by pleasure parties.

The limestones in No. 20 are mostly of a bluish color, and impure. Some of the layers would probably make hydraulic cement.

Below Raven Rock P. O. the Ohio river bends toward the west for more than a mile, and the rocks rise quite rapidly above its surface, bringing up the *Waynesburg coal* to 75 feet above the river.

The following Section (14) was observed on the Ohio river 2½ miles below Raven Rock :

1.	Sandstone, coarse, very massive, *Waynesburg*	35'
2.	Shales	5'
3.	*Coal, Waynesburg*, with a shale parting near centre	3
4.	Concealed to low water in Ohio river	80'

The *Waynesburg sandstone*, No. 1, stands out from the river bluffs in a very bold escarpment, and when followed down the river from this point thickens up to 50' or more, making an immense cliff that is constantly in sight until we come to St. Marys, the county seat of Pleasants, 3 miles below the locality of the last section.

The coal, No. 3, has been mined to a small extent, but is reported as slaty and sulphurous to such a degree as to be practically worthless.

At St. Marys the following Section (15) was made in descending the hill near the tannery :

1.	*Upper Proctor sandstone* left in small blocks on the summit of the knob from which it has been eroded	—
2.	Concealed to base of steep bluff indicating sandstone	140'
3.	*Red shale* and concealed	40'
4.	Sandstone	7'
5.	Sandy shales	20'
6.	Concealed and *red shales*	50'
7.	Shales, yellowish brown	5'
8.	*Sandstone, Waynesburg*, very massive, rather soft, micaceous, light gray	25'
9.	Shales, dark at base	5'
10.	*Coal, Waynesburg*	?
11.	Concealed	12'
12.	Sandstone, flaggy	3'
13.	Shales, variegated	7'
14.	Sandstone, rather massive	5'
15.	Gray sandy shales	5'
16.	Concealed to low water in Ohio river	35'
	Total	359'

The series of impure limestones seen in Section 13 at Raven Rock, where they are 50' thick and interstratified with *red shale*, were not observed in this section, being very probably covered up by surface accumulations in No. 6 of the above section, though it is quite possible that a large amount of the limestone has disappeared, since only a few layers of these rocks were observed in the steep hill-side above the *Waynesburg sandstone* at the locality of Section 14, three miles above St. Marys.

The Waynesburg sandstone has been quarried for building stone at this locality and also for the construction of bridge piers and abutments on the new Ohio River RR. It splits easily and dresses well into blocks of any desired size, but being somewhat feldspathic, it will doubtless not resist weathering very effectively. This stratum, No. 8, has been identified with the *Waynesburg sandstone* on the basis of its stratigraphical position, massiveness, and general features. Though it is not impossible that it may turn out to be the *Pittsburg sandstone*, and the coal under it the *Pittsburg coal*, since I am not satisfied with the sudden disappearance of the buff limestone group seen in the section at Raven Rock.

The Waynesburg coal, No. 10, has been mined on a small scale at this locality, but the opening was closed, and the coal concealed, except its blossom, at the time of our visit.

Not more than 300 yards southwest from the locality of the last section, the structure of the rocks shows the following (Sec. 16) succession:—

1.	Concealed from summit of knob	220'
2.	*Waynesburg sandstone*, very massive, feldspathic, pebbly near centre, yellowish gray	70'
3.	Shales	0'-5'
4.	*Waynesburg coal*, impure	1'-3'
5.	Fireclay and sandy shales	5'
6.	Concealed	15'
7.	Sandstone, massive	5'
8.	Concealed to low water in Ohio river	40'
	Total	363'

Here the *Waynesburg sandstone* has increased in thickness nearly three-fold inside of three hundred yards, at the same time growing quite coarse, and even conglomeratic, for at 50' above its base, a layer 3'-5' thick, is a perfect mass of quartz pebbles from the size of a pea up to a chestnut.

The shales under this sandstone exhibit erosion from the deposition of the latter, since they constantly change in thickness and the sandstone rests upon them with local unconformity.

The Waynesburg coal, No. 4, was also once mined to a small extent at this locality, but it is quite thin, varying in thickness from 1'-3', and contains much sulphur and other impurities.

When followed down the river from St. Marys, the rocks seem to rise quite rapidly, since we are now approaching the locality where the "Oil Break" of Volcano, Burning Springs and other places in Wood and Wirt counties, crosses the Ohio river,

About a mile below St. Marys some oil has been obtained at a locality known as Van Cluse. A 11-barrel well of light gravity oil was struck at a depth of 357 feet. The base of the *Waynesburg sandstone* occurs here at an elevation of 150' above the low water in the Ohio river, according to a barometrical measurement by student Hartigan, and as the oil well begins 30' feet above water level it would start 120' below the *Waynesburg coal*, or 130'—150' above the *Pittsburg coal horizon*, and hence the *oil rock* is most probably the *Morgantown sandstone*. This same stratum is an oil reservoir in the Dunkard oil region of Greene county, Pa., some of the largest wells found there having been obtained in the *Morgantown sandstone*.

Much interest attaches to the borings made in the Van Cluse district, since in none of them was the *Pittsburg coal* found. One well was drilled to the depth of 1300 feet, but no oil was found below the sand struck at 350 feet. In this boring a large bed of *coal* was struck at a depth of 700 feet. This would most probably represent the *Upper Freeport coal*, since it comes at the horizon where that bed ought to be found, viz: 550'-570' below the place for the *Pittsburg coal*.

The absence of the *Pittsburg coal* from the series at this locality was not expected, since it is so regular and persistent in its distribution to the north, or at least from Pipe creek northward. Just where this irregularity in the *Pittsburg coal* begins on the Ohio river is not now known, and nothing

but the drill can reveal it, since this is the first point below Pipe creek, 50 odd miles above here, at which we have had any information concerning the presence or absence of this important coal bed, because its horizon has been below river level all the time between the two points and no drill holes of which we could learn, have been sunk along the Ohio in this interval. It is possible that St. Marys may be the northern edge of the barren patch in the *Pittsburg bed* which extends through to Burning Springs on the Little Kanawha river, and with many interruptions of productive areas, spreads to the Great Kanawha and on south-westward to the extreme outcrop of the *Pittsburg coal*, near the Kentucky line, thus seriously impairing the formerly supposed continuity of this famous bed, and greatly reducing the area over which it can ever be mined. This *barren area* in the *Pittsburg marsh*, may, however, for ought we know at present, extend much farther north than St. Marys, possibly reaching to the vicinity of Sistersville, in Tyler county, half way to Pipe creek, so that no shafts should ever be sunk for this coal below Pipe creek without first sinking a drill hole to learn whether or not the coal is present.

One-half mile below Van Cluse, a very massive sandstone is seen making a line of cliffs along the Ohio side of the river with its base at an elevation of 210 feet above water level. Immediately under it is a bed of light gray limestone 2′ thick.

About one mile below Van Cluse, the following succession, (Sec. 17) was obtained in descending a steep hill on the Ohio side of the river:

1. Concealed from top to knob	5′
2. Sandstone, massive	35′
3. Concealed, gray, and *red shales*	50′
4. Sandstones	5′
5. *Red shale*	15′
6. Sandstone, shaly and massive	25′
7. Concealed	45′
8. *Red shale* and concealed	70′
9. *Coal blossom*	
10. Concealed to low water in Ohio river	105′
Total	355′

Just below this, another exposure gave the following Section (18) in descending to the Ohio:

1. Concealed from top of knob	15′
2. Sandstone, massive, weathering easily	30′
3. *Limestone*, light gray, below which come *red shales* with interstratified limestones	70′
4. Sandy shales, flaggy sandstone and concealed	105′
5. Sandstone, coarse, massive	30′
6. Concealed to low water in Ohio river	10′
Total	260′

These sections exhibit such a complete change in the character of the rocks from those exhibited in the sections at St. Marys that it requires very little credulity to believe that they are in a totally different geological series, and such indeed seems to be the fact, for in this vicinity the great "Oil Break" anticlinal of the Burning Springs, and Volcano district in West Va., crosses the Ohio river, carrying into daylight the horizon of the *Pittsburg coal*, and even bringing the *Crinoidal limestone* above water level. These facts were first brought to the attention of geologists by a paper published in the "American Journal of Science," for July, 1860, by the late Prof. E. B. Andrews, who states that the centre of the "Oil Break" arch crosses the Ohio river near the mouth of Conley run where a fossiliferous limestone, which he indentified with the *Cambridge bed*, is 65 feet above the level of the Ohio river. Some blocks of a fossiliferous limestone which looks much like the *Green Crinoidal bed* were seen scattered over the surface along the river's bank at the locality of Sec. 18, but the stratum from which they came was not found in place.

The horizon of the *Pittsburg coal* at the centre of the "Oil Break" uplift would be, according to Andrews, about 300 feet above the level of the Ohio river, and consequently should occur in the tops of the river hills if present in the series. But since no workable coal is known in this region, it follows that the uplift confirms the absence of the *Pittsburg bed* as a valuable seam from this region as already stated in connection with the Van Cluse oil borings.

A small bed of coal was once opened by Mr. Bell on the Ohio side, and one-half mile north from the river. It is reported as only 2 feet thick, and rather impure, and this is the only coal of which we could learn anything within the "Oil Break" arch.

Our limited time for work along the Ohio river where there is so much sameness in the rocks prevented our undertaking a study of the "Oil Break," since the region where it crosses the Ohio is quite poor in exposures, and we would necessarily have been compeled to go several miles from the river in order to work out its structure satisfactorily, hence in my statements concerning the extent of the uplift, I have trusted to the accuracy of Prof. Andrews' work, which in the limited examinations that we were able to make I found no reason for questioning.

From the locality of the last sections on down the Ohio, the hills recede from the river, and the rocks are mostly concealed with a thick covering of debris. When the rocks do stand out in cliffs they appear much broken and shattered. No sections were obtained between the locality of Sec. 18 and Marietta, a distance of 18 miles, and hence nothing positive can be asserted with reference to the geological column represented along the river hills, but there can be little doubt that with the exception of the narrow belt involved in the "Oil Break" arch, the most of the beds which make up the river hills belong to the Permo-carboniferous series, or to that portion of the column belonging above the horizon of the Waynesburg coal.

Erratum.—On page 142, the preceding one, 2nd column, 27th line from top, for 50′ put 30′.—*Ed.*

The Blast Furnace of the Crozer Steel and Iron Co. at Roanoke, Va.

By J. P. Witherow, Pittsburg, Pa.

(Read at the Roanoke Va., Meeting of American Institute of Mining Engineers, June, 1883.)

The blast-furnace plant of the Crozer Steel and Iron Co. was built under contract by Witherow & Gordon, of Pittsburg, Pa. The furnace is 70′ high by 16′ bosh, tunnel-head 12′ 8″, hearth 9′ in diameter. The columns are 20′ high above furnace level, below which they extend 2′. The shell is 23′ diameter at bottom and 19′ at top. The plate iron is ⅝ inch at bottom, and tapers to ¼ inch, the top ring being 5–16 inch. The furnace is provided with a double bell, which is 8 feet 4½ inches external diameter, and 4′ 4″ internal diameter, operated by a 32 x 63-inch air lift, and provided with safety-catch rods. The down-comer, which is surrounded with a spiral iron stairway, is 5′ 6″ external diameter and 4′ 8″ in the clear, at the bottom of which is placed a dust-catcher. The tuyeres, seven in number, and 7″ diameter, are placed 5′ 6′ above the hearth level, above which there are four circles of bosh-cooling plates, each plate being traversed with a 1¼-inch gas-pipe coil. The furnace is operated with three of the latest Whitwell fire-brick hot-blast stoves, 18′ in diameter by 70′ high, and each having over 24,000 square feet of heating surface. (One square foot of

the Whitwell surface is equal to from 2 to 3 square feet of any other type of fire-brick stoves for calorific duty.)

The products of combustion from these stoves are taken off by underground flues to an iron chimney, 160′ high by 8′ in the clear. This chimney also gives draught to a plant of ten steel boilers, divided into five distinct batteries. Each boiler is 34′ long, 46″ in diameter, and contains two 16-inch flues. Eight of these boilers, or four batteries, are expected to furnish an ample supply of steam for the whole furnace plant, leaving a battery of two boilers idle for repairs or cleaning. In the drawings of this plant it will be observed that an arch flue traverses the foundations, so as to communicate with the chimney for additional batteries of boilers, should a second furnace be added to the plant.

The engine-house is 31′ x 40′ in the clear, and contains two of the newest style of Weimer blowing engines; diameter of steam cylinder, 42″; blowing cylinder, 84″; and stroke 4′. This type of blowing engine is among the foremost in the United States for strength, efficiency, and durability, each engine having a maximum capacity of pumping 12,000 cubic feet of air per minute of piston displacement. The pumps are of the Cameron type; two for water supply, and two for filling boilers.

The engine-house is roofed with a sway-bottomed water tank, resting merely on the walls of the engine-house, without any other support, which is kept filled with water at all times for the supply of the entire plant. It is 6′ deep in the centre, and the surface of the water is 42′ 6″ above the hearth level, or engine foundation.

The casting-house is 138′ x 50′, outside measurement, and the stock-house 75′ x 150′. Both these buildings are roofed with corrugated iron, as is also the hoist-tower and bridge connecting it with the furnace. The hoisting aparatus is of the Crane Brother system, of Chicago, and the superstructure is wrought-iron channel beams.

This furnace has a cubical capacity of about 9,000 feet, and when worked up to its reasonable output, under intelligent management, will have a producing capacity of fully 100 tons per day, and can be worked up to 1,000 tons per week, if the manager so determine, on an ore containing 50 per cent of metalic iron, with silica not exceeding 6 to 8 per cent, at a temperature of blast ranging from 1,400° to 1,600° Fahr.

We would submit the following formulas, which we use in determining the capacity or output of a furnace; also in determining the size of its boiler, engine, and draught-stack.

We allow, for anthracite furnaces, 60 square feet of surface in boilers to produce a ton of iron in 24 hours; therefore, 6,000 feet of surface will supply steam to make 100 tons of iron in 24 hours. For coke furnaces we allow 40 square feet of heating surface for a ton of iron in 24 hours, or 4,000 square feet for 100 tons of iron in 24 hours; and for charcoal furnaces we give 30 square feet for a ton of iron in 24 hours, or 3,000 square feet for 100 tons of iron in 24 hours. This is assuming that the heat of the blast will range from 1,300° to 1,500° Fahrenheit.

By the same method we have determined that 140 feet of air per minute of piston displacement will make a ton of iron in 24 hours, with 50 per cent ores, if not too highly siliceous, at a temperature of blast above given; therefore 14,000 ft. per minute will make 100 tons in 24 hours. For charcoal furnaces, on the same ores and at the same temperature, we calculate 110 feet per minute to make a ton of iron, therefore 11,000 feet per minute will make 100 tons of iron in 24 hours. We assume that the chimney or smoke-stack must have a capacity for carrying off 15 tons of gas (or products of combustion) for every ton of iron the furnace is expected to make.

In deciding on the amount of limestone necessary for a blast furnace (apart from the analysis of the cinder) we have found it a good approximate rule to make the amount of lime (*i. e.*, the limestone less the carbonic acid) equal to the sum of the amounts of silica in the ores, limestone, and fuel. If more limestone is used it is injurious to good furnace action. It also saturates the escaping gases with an excess of carbonic acid, which lessens their calorific power. A furnace works sluggishly on an excess of lime, and is apt to scaffold.

Blowing-in.—The filling was done by using some 15 cords of wood, on which was put some 55 tons of coke, aad then the burden commenced by using 3,000 pounds of coke, 1,000 pounds of ore, and 800 pounds of lime. This was continued by slightly increasing the ore and lime until the furnace was filled. On Monday evening, May 28th, at 6 o'clock, the furnace was lighted by Miss Margaret Crozer, and the furnace given her name. At 1 o'clock p. m. the following day (Tuesday,) the blast was applied, and the waste gases of the furnace descended th· down-comer, traversed the large horizontal blast-tube flowed under the boilers and the Whitwell stoves, without the least explosion or even the faintest puff.

There was a difference of opinion with regard to the introduction of fire into the gas flue sometime before applying the blast. I maintain that a wood fire should be put in the flue, and I would be glad to submit this question to furnacemen.

The operations of the furnace went off satisfactorily. The hearth, however, was too cold for the reception of the ore. It would have been better, I think, to have put in from 3 to 5 cords of wood, just sufficient to thoroughly ignite the coke, then about 30 tons of coke, and commence with a burden of 3,000 pounds of coke, 3,000 pounds of ore, and 1,200 of lime, continuing this burden until the furnace is filled. As soon as the blast went on, I would have charged 3,000 of coke, and 4,000 of ore, and the same proportion of lime. I maintain that this is the proper way of blowing in a furnace. The use of a large quantity of cord-wood, with a small proportion of fuel on the top, and the burdening of a small proportion of ore to fuel, is not good practice, because the wood rapidly consumes, allowing the space that is occupied lo be replaced by coke and the furnace burden. Then the small quantity of ore is brought very near the tuyeres, before the blast goes on, and before the hearth is thoroughly heated; consequently this ore has a tendency to chill and settle in the bottom, if the furnace is not fortified by the Whitwell stoves. Where a smaller quantity of wood, and a larger proportion of coke is put on, with a greater burden, the hearth is filled with incandescent coke, and liquefaction is retarded until the hearth is in a condition to receive the iron and cinder. The regular process begins on a large scale, the hearth becomes filled with hot cinder, the process of combustion goes on steadily, and the heat in the stoves is gradually increased; so that no matter how dark the cinder may be for the first day, which is most desirable, the heat will develop more rapidly than the burden can be increased. Within three days the temperature of the stoves must be reduced, or the cold blast put on, so as to keep down the heat, to prevent the iron becoming too gray or silvery. A furnace supported with superheated blast should, therefore, always be blown-in on a reasonably heavy burden, and the manager should desire dark cinder for the first two days, and gradually increase his ore burden until he is satisfied that the proper proportions are on the furnace.

The Whitwell stoves are frequently blamed for the bad working of furnaces, and for unsatisfactory results in an economical point of view, when the whole trouble is in the management. The old practice of blowing-in furnaces is still not unfrequently adopted, that is to say, a great excess of fuel and everything calculated to produce a very gray

cinder, and a No. 1 or No. 2 foundry iron at the start. This is not good practice. An excess of fuel is resorted to for the purpose of making the furnace very hot, and may be justified in cold-blast charcoal practice. Where the heat of the blast ranges from 500° to 800° with iron-pipe stoves (commencing at 100° or 200°,) there may also be some reason for continuing the old practice. In modern practice, where the furnaces are supported with superheated blast, the fallacy of such a course has been demonstrated, and it is surprising to see it still pursued. This course is often maintained long after the furnace is in blast, and as the heat of the stoves augments in a greater ratio than the increase of burden, the carbonic oxide has little to do in the zone of combustion or the region of the tuyeres, and as the gaseous currents ascend in the furnace, they establish partial liquefaction and cementation in the upper regions of the bosh, often continuing this action up the inwalls, causing scaffolding and bridging. With such a course, especially in anthracite furnaces, the blast is bound to be a failure, as the removal of such obstructions is difficult and rarely effected.

I think that blast-furnace engineers should establish a system of runing the furnace by the temperature of the escaping gases. This temperature indicates the changes more quickly than the cinder or the iron. Other things being equal, the hotter the blast the cooler the top, and *vice versa*, and the increase of temperature at the tunnel-head will sooner indicate to the manager a derangement in furnace action than anything else. As the temperature of the higher zones increases, it will show that there is either an inadequate amount of ore and lime for the ascending gaseous currents and carbonic oxide to act upon, or it will show that the furnace is begining to cement and scaffold, and prompt measures can be taken to remedy the difficulty.

Postscript.—The amount of foundry iron weighed to-day for yesterday's output was 77 tons, which is the fifth day of the furnace's operations. The fuel is very close to a pound of iron with a pound of coke, the furnace being under a burden of nearly 2 pounds of ore to 1 of coke, and the ore yielding over 50 per cent metalic iron. This indicates that within a few days this furnace may be making over 100 tons of iron per day, on a fuel consumption not exceeding a pound of coke to a pound of iron.

The Natural Coke of Chesterfield County, Va.

By R. W. Raymond, Ph. D., New York.

(Read at the Boston Meeting, Am. Inst. M. E., Feb. 1883.)

The substance known as carbonite, or natural coke, has been several times the subject of comment before the Institute. The most important contribution hitherto made to the discussion is that of Dr. Henry Wurtz, of Hoboken, (Trans. Am Inst. M. E., vol. iii., p. 456,) who states, upon the strength of a chemical analysis, that carbonite is not coke, but contains 14.08 per cent of volatile combustible matter.

In 1882 a mine was opened upon a carbonite seam, near Midlothian, Chesterfield county, Va , by Messrs. Jewett & Bro., of that place. The seam, which dips westerly at an angle of about 30°, was struck at the depth of 137 feet with a vertical shaft, and followed on the dip 325 feet, at which depth gangways were opened north and south. For these statements (having made no personal examination of the locality), I am indebted to Mr. Albert Blair, of Richmond, and for the following section,to Mr. John Blandon, engineer at the mine. The section was taken in the face of the gangway, February 17th, 1883. It shows an aggregate thickness of 15 feet of "coke," of which about 5 feet were extracted by the system employed last winter

Section in Jewett & Bro's Colliery.

Whin rock	2′ 6″
Hard arenaceous shale	6′ 0″
Dark shale with laminae of coal	1′ 0″
Carbonite	2′ 0″
Dark shale	1′ 3″
Carbonite	1′ 9″
Shale	0′ 1″
Carbonite	9′ 0″
Fire-clay	0′ 4″

Thin layers of whin rock, occasionally.

It is reported that under the "coke" seam there is a thick seam of highly bituminous coal, which has been extensively worked on a neighboring property, a little south of Jewett colliery, and was sold for gas-making.

The carbonite is used for domestic purposes, and is said to burn like anthracite, without smoke or soot, and to be less injurious than anthracite to stoves, etc. This report, though popular and unscientific in character, is worthy of attention. The difference between anthracite and bituminous coal, in the manner of burning, is one concerning which it seems unlikely that the most careless observer could be mistaken; and if the average carbonite contains, like the sample analyzed by Dr. Wurtz, over 14 per cent of volatile combustible matter, its behavior in burning is certainly peculiar. This consideration led to the analysis of samples obtained through Mr. Blair from the Jewett mine.

The old view, that carbonite was due to the coking of the original seam by the intrusion of a trap dike (expressed in the address of Maj. Jed. Hotchkiss before the Society of Arts, at London, in 1873) would be more more plausible if the presence of a trap dike large enough to produce this effect. and so situated as to produce it upon a single bed alone, and not upon overlying and underlying beds, could be clearly shown. The existence of such a dike has been disputed; and all that I can say on that point is, that among the samples of the country-rock sent to me from the locality, there was no eruptive rock.

Chemical Examination of Carbonite, by Dr. T. M. Drown.

The samples of carbonite mentioned above were not uniform in character. The fragments could be readily separated into a dull portion and a lustrous portion. These were examined separately. In general, the analyses confirm the statements of Dr. Wurtz already refered to by Dr. Raymond.

Proximate Analysis.

	Dull portion.	Lustrous portion.
Specific gravity	1.375	1.350
Loss at 100° C.	2.00	0.69
Volatile matter	15.47	11.10
Ash	3.20 (dark brown)	6.68 (white)
Fixed Carbon	79.33	81 52
Total	100.00	100.00
Sulphur	4.08	1.60

The large amount of sulphur present, particularly in the dull portion, suggested an examination to determine the condition in which the sulphur exists in this coal. Advantage was taken of the action of an alkaline solution of bromine to determine the sulphur which is present as pyrites or other metalic combinations. This method of analysis was described in full by the author in the *Transactions* of this Institute, vol. viii., p. 569, and vol. ix., 656.

Analysis by the Bromine Method.

	Sulphur by BromineSolution (Pyritous Sulphur	Sulphur in Residue, determined by Eschka's Process. (Organic Sulp'r)	Sum of the Preceding.	Total Sulp'r by Eschka's Process.
Dull portion	3.48	1.41	3.89	4.08
Lus. portion	0.247	1.326	1.573	1.60

The amount of iron in the dull portion is 2.29 per cent, in the lustrous, 0.31 per cent. If this iron were present in both cases as FeS , the amount of corresponding sulphur would be 2.62 per cent and 0.35 per cent respectively. The dull portion was considerably weathered, and contained a large quantity of sulphates soluble in water, and was not, therefore, as well suited to this investigation as it would have been if the pyrites had not been oxidized.

A mechanical examination was attempted of the lustrous portion to see if it would throw any light on the condition of the sulphur; 102 grams were pulverized so as to pass through a seive of 35 meshes to the linear inch; and this was then sifted through bolting-cloth of 96 meshes to the inch; 34 grams, or one-third, was retained by the cloth, and 68 grams, or two-thirds, passed through.

The sulphur was determined in these two portions by Eschka's method, and practically no difference found. The finer portion gave 1.66 per cent sulphur, and the coarser portion 1.60 per cent.

A portion of the coarser powder was then treated with the Thoulet solution (iodide of mercury in iodide of potassium) of 1.369 specific gravity; 10.21 grams were lighter than the solution, and 5.24 grams were heavier. These two portions were then examined with the following results:

Analysis of the Lustrous Portion Treated with the Thoulet Solution.

	Sulph'r by Bromine Solution.	Sulphur in Residue by Eschka's Process	Sum of the Preceding	Total determined by Eschka's Process.	Metalic iron.
Lighter portion	0.203	1.427	1 630	1.70	0.27
Heavier portion	0.341	1.270	1.611	1.59	0 47

The lustrous portion, owing to its smaller amount of sulphur, was not as well fited for this examination as the dull portion would have been, but the sample of the latter at my disposal, as already mentioned, was so much oxidized that it was unsuitable.

The above analyses are interesting, as far as they go, in tracing the sulphur which exists in the samples examined, but it would perhaps, not be fair to draw any inferences from them, regarding the amount and condition of the sulphur in carbonate. Larger, and thoroughly average samples, would be required for this purpose.

The foregoing determinations were made by Mr. P. W. Shimer.

The Cannel Coal of Coal River, W. Va.—Commenting on the article of Maj. Thos. L. Broun, of Charleston, W. Va., on Coal River coals, that appeared in our last number, the "Coal Trade Journal" of New York says: "Some land owners out on Coal river, W. Va., are trying to get up a company to develop their lands. So far very good, but when they say in New York city twenty million bushels of the Coal River Cannel coal can be sold every year, with large profit, to put it mildly they are very wide of the truth. It is doubtful if one-tenth of this quantity is or can be used to advantage."

Under date of Sept. 18, Major Broun writes to *The Virginias:* "The 'Coal Trade Journal' makes issue with the statement contained in the Coal River Prospectus that 'in New York city twenty million bushels of the Coal River Cannel coal can be sold every year, with large profit'; at the same time it quotes Kanawha gas-coal at $4.75 and Cannelton gas cannel coal at $9.50 per ton!

This criticism if founded on the supposition that there is no demand for Coal River Cannel coal *as a fuel;* that it is only wanted *for gas purposes,*—and that for such purposes the demand is limited. The facts are that a considerable quantity of English cannel is used in New York for fuel, the consumer supposing that no American cannel is equal to the English in quality for grate purposes, while the truth of the matter is that the Cannel coal from Coal river does not 'fly' or 'pop,' when burning, and is in all respects equal to the best English cannel *for fuel;* as has been demonstrated during the past 15 years by persons who reside near the cannel coal beds who have used this cannel coal almost exclusively for their fuel. Little or none of the best cannel coals of West Virginia, those free from poping when burning, has as yet been mined and transported to market.

The Coal river region has such cannel coal in the greatest abundance, but it is at yet inaccessible to market. The construction of the Coal River RR. will place these rich beds of cannel coal in direct railway connection with Newport News and thence by water with New York; that done, the very best Coal river coal can be placed in that city and sold at $6.50 per ton, at that price yielding a large profit.

As to the quantity of this Coal river cannel that can be sold *as a fuel*, if offered at $6.50 per ton in New York, (not at $9.50,) it is now only a matter of opinion. Persons familiar with the coal business in the Eastern cities, and especially with their preference for cannel *as a fuel*, say that good cannel coal, at prices ranging from 25 to 30 per cent only *above* bituminous coal, can find a ready market in New York and other Atlantic cities, for such quantities as I have stated. This is an opinion, which, it is believed, will be verified when the Coal River Railway is constructed and New York is put in direct connection, by rail and water, with the remarkable deposits of cannel coal that have been opened on Coal river, in Boone county, West Virginia."

The North mountain Coal-field, in Botetourt county, Va., (or as some call it Catawba, or Caldwell, or Brushy mountain) is one of the best of the fields of the No. X, the Vespertine, or Lowest coal measures, fields in Virginia. Its coals have long been used locally and many persons have at different times believed they would become commercially very valuable if properly developed.

There coals have, as we have before stated, a greater or less *local value*, dependent on the local condition of the strata in which they are found, but we do not attach any importance to them for commercial purposes, as they cannot furnish the basis for large mining enterprises, as their areas are limited and their beds are crushed, broken, and cut off by profound faultings.

Among the papers of the Catawba furnace lands, in which most of this Botetourt coal-field is embraced, we have found some statements concerning these coals which we deem worth publishing, as they are records of observations made in mines then open but now closed.

During our late civil war Mr. Oswald J. Heinrich made a report on these coals, for the Confederate States authorities, from an inspection of mines in them, under date of Feb. 12, 1864, from which we extract the following:

"The seam of coal mentioned above, which has lately been opened, is the upper seam which was mentioned in my report of last year as 3′ thick. An old tunnel has been reopened into this since my former visit. The mouth of this tunnel is at Stone Coal run, about 25′ or 30 below the road; it has been entered 40′ or 50′ into the hill side. The seam of coal is 10′ thick, divided into two benches by about 18″ of hard slate. The lower bench is from 3′ to 3′ 6″ of solid coal, the upper from 4′ to 5′ of solid coal, making in all from 8′ to 8′ 6″ of coal. The coal at present is of a friable nature, being too near the surface. The seam being a very large one and opened immediately on the creek, where water and atmospheric influences have, of course, operated most

vigorously and destroyed the character of the coal to some extent. Samples which I procured yielded:

Volatile matter.....	12.2	Residue ashes.....	9 8
Fixed carbon.....	78.0	Sulphur.....	a trace

The remaining ash is almost perfectly white. The structure of the coal is slightly laminated, fracture uneven and slightly conchoidal, color pure black, lustre sub-metalic. No impurities are perceptible in the coal.

From such a seam of coal, at a distance of only 400′ from the outcrop, or 300′ perpendicular depth, by an inclination of the seam of 40°, a slanting depth of 467′ is obtained; therefore in the course of a mile linear extent 730,595 solid yards of coal may be obtained. Allowing one-fourth for waste and pillars left in the mine, there still remain 547,947 solid yards of available coal. One solid yard of such coal is nearly equal to one ton, and from 500,000 to 550,000 may be obtained, even at the moderate depth of 300′ from the outcrop.

But from the creek above water level the coal passes into the side of the mountain to at least 100′ or 150′ in height; this again will afford at least 250,000 tons, so that in all a supply of about 800,000 tons may be obtained at the most convenient depth for mining. At the present time, of course, only the portion above water level ought to be mined, but at the same time an experimental shaft or slope ought to be sunk to prove the depth of the coal as well as its linear extent.

This upper seam of coal is known to exist on the Catawba Furnace lands one mile northeast of the place where it has now been opened. It would be of great importance to test the existence of this seam, both in its linear extent as well as its depth. If it should be proved to exist even for the distance of several miles, and for the limited depth stated above (of which I have no doubt, because no interruption of any consequence is visible at the surface), the amount of coal which could be obtained would fully justify the expense of connecting this point with the navigation of James river by a tram-road."

Mr. H. then gives an account of a very practicable route for a tram-way from this coal and iron field down Catawba creek and across to James river to opposite what is now Jackson station of the Richmond & Alleghany R.R., which he estimated could be constructed in ordinary times at from $2,500 to $3,000 a mile, using flat rails. He also recommended an experimental survey for this tram-road, a further testing of the coal-field; and adds:

"The importance of this coal was fully established last year, and I need only say now that at any time this coal could compete with any other coal that could be brought to the Richmond market."

A table is then given showing that this coal can be taken to Richmond by from 14 to 16 miles of tram-way and about 208 miles by James River & Kanawha canal, which was then in operation to Buchanan, and cheaper than the Price or the Brushy Mountain coals of Montgomery, which he classes as "inferior" in comparison with this and Rumbaugh's, in Pulaski, which he classes as "superior;" adding:

"In ordinary times the coal from Stone Coal gap could be brought into competition with the anthracite imported from the North. It is nearly as well adapted for domestic as for manufacturing purposes, and could be brought to Richmond at the same rate if not lower than anthracite has been sold in the Richmond market, even at the lowest price in the summer season.

As far as geological observations can throw any light on the subject, I do not hesitate to say that further investigations by actual mining operations ought to be made; and only such can fully establish the items for future investments. Such operations may be conducted at a limited expense, but are indispensable to establish the full value of that deposit."

Capt. A. B. Fairfax, of the C. S. Navy, to whom this report was addressed, endorsed upon it, on sending it up to the head of the Navy department, "the recommendation that energetic measures be used to open and use the coal from the newly developed seams of 10′ thickness, 8′ of which may be counted on as clean coal, and to fully test its fitness for smelting iron ore and for cupola work; and should the quality prove as satisfactory as it promises to do, an improvement in the means of transportation to navigable water is demanded by the urgent wants of the public service."

From a report on these Botetourt coals made by Oswald J. Heinrich, C. & M. Eng., Jan. 29, 1866, to S. Hastings Grant, Esq., New York, by request of Dr. Grant, we make the following extracts:

"The character of the coal in question is semi-bituminous, and consists, in average, of: Volatile matter 12 to 14 per cent, Fixed carbon 75 to 78 per cent, and Residue ashes 5 to 9 per cent.—The coal is very free of sulphur and leaves a white ash. It has been found superior to any coal east of the Alleghany mountain for smelting pig metal in cupola furnaces and for generating steam.

There are two principal seams now developed. The lower of these is about 5′ thick with 2′ of coal in it; the upper seam is from 10′ to 12′ thick with from 6′ to 10′ of coal in it. They are best developed on Stone-coal run in Caldwell mountain near Catawba furnace.—The quality of the coal of the lower seam is already proved, beyond all dispute, to be superior in regard to purity as well as compactness. The coal in the upper seam, more influenced by atmospheric actions in consequence of its thickness, has evidenced so considerable improvement in character by sinking on it, that no doubt exists but that the coal will be just as pure and hard enough to bear the burden of a furnace. The coal is less in solid masses, but more in the nature of hard chunks surrounded by coal of a more friable nature. All the work heretofore done on this seam of coal was sinking on it, in a slope, for 85′ to 100′. No drifting has been done, consequently the coal does not show itself to its full advantage. The seam is subdivided by a stratum of slate, forming two benches, but the coal itself is very free of slate.

The extent of this coal, as far as I have explored the seam, is about 5 or 6 miles in length, but no doubt exists of its continuation. The width of the narrow trough at its northeastern terminus, where the only explorations so far have been conducted, is about one-half or three-fourths of a mile, widening as we go to the southwest. At this N.E. point it presents only a western outcrop, the eastern one being covered by overlying formations. Indications are favorable that on its southwestern extension both outcrops may be obtained and a full basin discovered.

The dip of the coal averages about 40°. Taking that as the general dip, an acre of this coal land will yield from the small seam about 2,000 tons of lump and 1,000 tons of fine coal; from the large seam about 4,500 tons of lump coal and 4,000 tons of fine coal (in the condition the coal presents now) may easily be obtained per acre. At a safe calculation 10,000 tons of available coal could be calculated on per acre, making due allowance for all the amount necessary to be left in the mine for pillars and wastage and for 'troubles'. which may occasionally cut out the coal.—At least 2,000 acres of land are now known to be underlaid with coal; this at the above rates would furnish about 20,000,000 tons of coal."

W. Va. Indian mounds.—In the "Evening Call" of Charleston, W. Va., of Sept. 25, 1883, is an anonymous letter from which we make the following interesting extracts:

Prof. P. W. Norris, an ethnologist, has lately opened some of the mounds along the Great Kanawha and found numerous relics of antiquity and specimens of workmanship in flint stone, that might have been made by a race superior in intellect to the Indian whom we know and have seen within the past half century. His operations so far have been confined to the mounds and graves on the north side of the river; and among the articles found are some pieces of iron implements, together with arrow-heads of flint and some pieces of human bones These probably are of a later period, for it is rare that bones that have been buried in the bottoms longer than fifty or sixty years remain perfect, for where there is constant moisture in the earth, they more quickly perish. He exhibits a piece of flint half an inch wide and three inches long, resembling the blade of a pocket knife; he calls these knives and supposes they may have been used for skining the animals upon which they fed, and for other various purposes. They are slightly curved, sharp on both edges, but without handles, or if any had ever been in use they were made of more perishable material. He says they are to be found everywhere, wherever there was a habitation of these early settlers, and many hundreds of them have been found between the lakes and as far south as Florida. He has sent from here a large collection of these relics to the Smithsonian Institution. The Professor is making arrangements for an examination of the mounds on the old Thomas farm, on the south side of the river, and as he thinks from his explorations that these points were once the head-quarters of these ancient people, perhaps where they had their temples, held their games and festivals, there may be relics rare and unique, and in greater profusion than any he has yet found.

There is said to have been discovered the remains of an ancient pottery or earthen-ware factory in Teazes valley. He has been invited to visit that that locality, and will do so before he finishes his explorations about here.

We have never heard of any mounds in the bottom where Charleston stands, except the elevation upon which is the residence of J. M. Laidley, nor whether that was ever examined with a view to discover its contents. From the depression in the earth at the northeast and northwest sides of the house, this might be classed among the works of the mound builders, long before the period of Indian occupation. This bottom is supposed to have once been an island. The oldest inhabitant has not said he had ever heard the oldest inhabitant of his day say it was, but the depression at the narrows at the head of the bottom, and the low ground at the base of the hill would indicate that a thousand or more years ago, the river divided at the narrows above town. The aborigines left no records. We may look for a history of these discoveries at no distant day, which the Smithsonian may put out. No book of modern times can be made of more interest than such a record.

Geodetic Survey station Names in W. Va.—Some time ago we wrote to Assistant A. T. Mosman, of the U. S. Coast and Geodetic Survey, concerning the names given in West Virginia to some of the stations in the trans-continental triangulation that is now being made by that survey along and near the 38th and 39th parallels; the following extracts, from his reply, give important geographical information.

"In answer to your note of March 21, 1883, I will say that I can give no satisfactory account of the origin of the name 'Townsend.' It is the local name of a sharp peak on the range diviving the waters of Paint creek from those of Coal river; the people there pronounce the name Town's *End* and I have never heard that it was named after any particular man, although it may have been. No pole was erected there and the peak is not a very high one It probably received more attention from me than it deserved, because it was directly in the line between the stations Summersville and Ivy, and at one time it was doubtful if the line was intervisible. I have alwavs retained the local name of a hill when I could ascertain that it had one. Paint Creek had no local name, and at the time I visited it, I left two trees standing to mark it, thinking it possible that I should have to make a station tbere if I could not see from Ivy to Summersville.

Table Rock is named from a peculiarly shaped rock on the same ridge, about half a mile north of the station, and called by the people near Tea Table Rock. Ivy, Keeny, Paddy and Briery are local names. Bald I named, as it had no local name, but the whole range is called on the map Warm Spring mountains. Cold, Job's, Grassy and Beech knobs are local names. Holmes was named by me from its owner; Pigeon is a local name; Davis from Davis creek; Gebhardt, Wray, Gould, Howland and Johnson from their owners.

Oakland is near the old Oakland furnace and Buena Vista is between the old Buena Vista and Hunnewell furnaces in Kentucky. 'Scioto' was named by me and is a *fancy* name, as I could find nothing better to distinguish it. It is in Scioto county, not far from the mouth of Scioto river and about three miles from Portsmouth, Ohio."

Forest products traffic of Norfolk & Western RR. 2nd quarter of 1883,—The eastward movement was 27,296 tons, of which 16,127 were lumber, 4,897 logs, 4,933 staves, and 1,339 wood.—The shipments were from stations all along the road in each grand division of the state, but fully one-third of them were from beyond Bristol. From the New River branch came 430 tons. The destinations of the traffic were mainly to Boston, New York, Baltimore, Norfolk, Richmond, Petersburg, Lynchburg and Shenandoah Valley RR.; nearly half of it went to Norfolk, probably for export to foreign countries.

The westward movement was 6,771 tons of lumber and 1,463 of wood; total 8,231. This was mainly an interchange between stations of the railway.

Live Stock Traffic of Norfolk & Western RR. 2nd quarter of 1883.—The movement eastward, in 2,000 lbs. tons, for the quarter was: of cattle 764, hogs 174, horses and mules 260, and sheep 1,089; total 2,287.—This movement was mainly from Va. stations in The Valley and from beyond Bristol; of this the destination of 683 tons was to Shenandoah Valley, 232 to Va. Midland, and 128 to Richmond and Danville railways, and 112 to Norfolk.

The westward movement was 93 tons of cattle, 22 of horses and mules and 23 of sheep; total 138; mainly an interchange between way stations, though part of the movement was of stock sent west and southwest.

James River Iron-works, 4 miles above Lynchburg, on Richmond & Alleghany RR., says *The Virginian,* have been bought by Col. A. H. Leftwich for $75,000; he will convert the establishment into a nail-works.

We hope Col. L. will prepare his plant for making *steel* nails, the ones that will soon be much in demand and for which he will be able to procure a cheap raw material before long; for some one will, in the near future, have foresight enough to put up a basic steel plant in Central Virginia where ores adapted to that process are very abundant.—The new nail mill at Ironton, Ohio, is being constructed so it can be readily and cheaply made a *steel nail* mill.

The Virginias.

Serial No. 46. Vol. IV.—No. 10.

Staunton, Va., October, 1883.

Jed. Hotchkiss, - Editor and Proprietor.

Table of Contents.

Errata.—In Prof. White's article, on page 124 of the August number, 2nd column, in 27th line *from bottom*, for *Washington read Waynesburg*; in 26th line, for in read is; from 25th line erase was; and in 17th line for No. 23 read No. 25.

In Prof. Dewey's paper on Porosity, etc. of Coke, on page 104 of the August number, in the 5th column of the table, headed, Volume of cells in 100 grams, c c., for cubic centimeters, should have been placed after the numbers of that column. In the 6th column the number next to the last should have been 48.07. In the 7th column for M. M. Jenkin, read N. M. Jenkin. In the column headed Kind of Furnaces, the last five lines should be raised one space. In the column headed Size of Furnace, the figures 65′ × 14′ and 65′ × 16′ both belong to No. 9. In the last column the last three figures should be raised one space. In the last line, for "the water" read "the analysis," omit "in" after "coke", change "is" after "11 ' to "are," and make "average" "averages."

In Prof. Dewey's measurements of Dora drill holes, page 106 of July number, in No. 1 drill hole, put measurement of No. 4, Silicious slate, 4", not 4'; put No. 12, Dark slate, 5½', not 5'; put No. 14, Slate, 3½", not 3"; and in No. 28 for "pliable," read friable, and for 10", put 10½". In No 2 Drill hole, after No. 2 put an omited stratam of Sandstone and slate, 12′ 4".

The proof sheets of the papers were not seen by their authors, and they have called our attention to these slight errors.

Kanawha coal shipments.—Says the Kanawha Gazette of Oct. 27th: "About 2,000,000 bushels of coal have been shiped from the Kanawha mines in the last few weeks." That reads large, but it was only some 5,000 tons after all; not more than one fourth what should be shiped from that region every day.

Three Decades of the Growth of Virginia.

(Continued from page 134.)

The nativity of the population of the grand divisions and of the state, at each census of the three decades, was as follows:

1. Native born Population.

	1860.	1870.	1880.
Tidewater	309,209	339,480	414,119
Midland	366,502	359,923	439,007
Piedmont	208,724	206,120	250,435
Blue Ridge	24,454	28,512	39,609
The Valley	192,195	196,397	249,423
Apalachia	64,213	80,937	105,178
Virginia	1,201,117	1,211,409	1,497,869

2. Foreign born Population.

	1860.	1870.	1880.
Tidewater	7,271	5,406	5,471
Midland	4,543	3,969	4,291
Piedmont	1,008	1,084	1,329
Blue Ridge	40	46	37
The Valley	2,096	1,570	1,703
Apalachia	1,956	261	233
Virginia	18,513	13,754	14,696

These tables show that the population of Virginia is made up, almost exclusively, of people born in the United States, the foreign element being but a small fraction of the entire population, not even in Tidewater, with its commercial cities.

The race population of each grand division and of the state, at each census of the decades, was as follows:

1. Whites.

	1860.	1870.	1880.
Tidewater	166,129	168,658	201,578
Midland	164,800	161,996	198,140
Piedmont	115,236	121,107	148,138
Blue Ridge	23,017	26,479	37,029
The Valley	153,517	159,927	199,628
Apalachia	67,974	73,922	96,345
Virginia	691,773	712,089	880,858

2. Blacks.

	1860.	1870.	1880
Tidewater	177,663	178,332	213,691
Midland	206,234	201,904	245,151
Piedmont	83,896	86,085	103,620
Blue Ridge	1,383	2,079	2,617
The Valley	60,872	38,027	51,478
Apalcahia	7,817	7,270	9,059
Virginia	527,763	512,841	631,616

Of Chinese there were 4 in the state in 1870 and 6 in 1880; of Indians, 94 in 1860, 229 in 1870, and 85 in 1880. These Indians were some of the scattered remnants of former Virginia tribes; others were from the Indian Territory that had come here during the late war and remained.

A Pear-tree in Logan county, W. Va., is reported by the St. Albans Nonpariel, to be 9 ft. in circumference at its base. The scion from which it grew was brought from Campbell county, Va., by a Mr. Stone, in 1790.

Dora Anthracite Coal: two opinions about it.—A few months ago there appeared in the local columns of the Baltimore Sun, under the caption of "*Specimens of Virginia coal*," the following statement:—"Mr. R. N Pool, a Virginian, who for some years has resided in Philadelphia, is stoping in Baltimore at Barnum's. He has for a long time been engaged in geological investigations into the mineral resources of the Virginia Valley region. He brought with him to Baltimore some handsome specimens of anthracite coal from a basin of that deposit near Rawley, twelve miles from Harrisonburg, on the Valley Railroad of the Baltimore and Ohio system. The coal is a beautiful white-ash anthracite, which, he says, shows better than Pennsylvania Lykens Valley coal in analysis. It is an older deposit than the Pennsylvania anthracite, and this fact may have led to the statement of Major Hotchkiss before the American Institute of Mining Engineers that there is no anthracite deposit in Virginia worth anything as a commercial commodity. Mr. Pool, following the report of Rogers in 1836 on the geological resources of Virginia, has labored in that field since 1875, and spent thousands of dollars in his investigations He used the diamond drill in his researches after anthracite, and says the facts established are incontrovertible that the deposit exists in veins of three to eight feet in a territory 40 miles in extent, of which Rawley and Brock Gap are the basins. He considered the supply very great, and that the coal is the purest anthracite known. He believes that the established existence of this coal will be of great advantage to Baltimore. A branch of a few miles from Broadway, on the Valley Railroad, will lead into it, and one of 12 miles to Rawley will tap the basin there. The iron ore deposits of the same region are also said to be very rich."

In Taylor's Statistics of Coal, 1855, p. 294, we find the following: "At a meeting of the American Association for the Advancement of Science, May, 1854, Mr. H. R. Schoolcraft brought forward a paper on the Dora coal formation of Virginia, which was answered by Prof. W. B. Rogers, a brief summary of whose remarks on the subject we beg leave to subjoin:—

"This Dora bed was no new discovery. Twenty years ago it was explored. It lies some 16 miles from Staunton, in Virginia. It was a thin and illusive coal-bed. Rumors of its wealth had often stimulated speculators to their ruin. Companies had often been formed with the intention, first of working the stock; and second, possibly of working the coal. The section that he had seen was worthless. He had heard of a seam 15 feet thick. But the rocks there are piled up topsy turvey. The older Silurian rock overlaps the Carboniferous limestone. The rock that we are accustomed to designate as No. II, rides over No. X, and all between have entirely disappeared. In one place the coal seam was four inches, in another four feet thick, and in others you might call it 15 or 20 feet thick of shale and coal, according to the direction of your measurement. When one falls upon one of these rich pockets the rumor flies, and the proximity to market makes up a fever of excitement. He did not affirm that it was worthless, but in the lack of definite data, and with no adequate sections of it, he anticipated no large resource of coal from the Dora bed."

We now have "definite data and adequate sections," obtained by the expenditure of tens of thousands of dollars in driving tunnels, sinking shafts, and taking out diamond-drill cores. These all lead to but one conclusion, which is that this entire field, from North River gap to Brock gap, cannot be relied on, in any portion of it, for coal for commercial purposes.

The Kanawha Cannel Coal Co. is operating on Paint creek, Kanawha county, W. Va.; it sends its coal over the Paint Creek R.R. to the Ches. & Ohio Ry, and to the Great Kanawha river.

Progress in the South.—The New Orleans Times-Democrat of Oct. 20, has an article on the growth of the South in the last 4 years, or since the census of 1880. It gives the following comparative figures for the 12 Southern states:

Assessed value of property in 1883,	$2,824,934,575
do " " " " 1879,	2,184,227,547
Increase in 4 years,	$640,707,028
Rate of taxation in 1883,	4 1-2
do " " " 1879	5 1-12
Decrease in 4 years,	7-12
Mileage of railways Oct. 1883,	26,049
do " " Jan. 1879,	17,260
Increase of mileage in 4 years,	8,789

The increase in the assessed value of property was an average of $160,176,757 per year. The increase of railway mileage was one-fourth of the increase for the whole United States, and the decrease in taxes was 7-12ths of a mill on the dollar.

The following are the figures of the above given for Virginia:

Assessed value of property in 1883,	$332,000,000
do " " " " 1879,	315,576,822
Increase in 4 years,	$16,423,178

Her tax rate is stated as 6, or 6-10ths of one per cent, in 1879, and 5, or one-half of one per cent, in 1883. The gain in the value of property was 5 1-5 per cent.

Miles of railway in Va., Oct., 1883,	2,500
do " " " " Jan, 1879,	1,646
Increase of mileage in 4 years,	854

The increase of the mileage of railways in Virginia, in the 4 years, was over 52 per cent, by this statement.

Our usually accurate cotemporary, the Baltimore Journal of Commerce, blunders in an article appropriating the above facts, when it states the taxation as so much per cent; when it should be so many mills on the dollar or so much of one per cent. If it were per cent our taxes would be very heavy, when in fact they are very light.

Tin Ore in Virginia.—A considerable lead of tin ore has recently been prospected on Irish creek of South river of the James, on the western slope of the Blue Ridge, Rockbridge county, Virginia, a few miles from the line of the Shenandoah Valley RR., and not far from Vesuvius or Midvale stations. Elsewhere we publish an interesting letter from our greatly esteemed young friend, Harry G. Campbell, the assistant professor of Geology and Chemistry at Washington and Lee University; below will be found interesting extracts from a manuscript report, by Andrew S. McCreath and Franklin Platt, of the Second Geological Survey of Pennsylvania, made to President F. J. Kimball, of Shenandoah Valley and Norfolk & Western railways, under date of October 15, 1883.

"We have visited and examined the tin ore deposit on the Cash lands in Rockbridge county, Virginia. The openings are from 7 to 8 miles from Vesuvius station of the Shenandoah Valley Railroad, over a mountainous, and for the most part of the way, a very poor road Starting from Vesuvius station at 1,428 feet above tide, the road crosses a summit at about 3,100 feet above tide and then descends to Opening No. 1 at 2,450 feet and Opening No. 2 at 2,700 feet above tide.

The ores could also descend Irish creek for 14 miles to

reach the Shenandoah Valley Railroad, a poor road, but without mountain crests to climb. While this would make expensive hauling, yet a really good tin ore could well stand this amount of hauling charge.

The tin ore is opened in the crystaline rocks, of the Blue Ridge, underlying the Potsdam sandstone, No. I of our geological nomenclature. These crystaline rocks are almost or nearly vertical, much twisted and contorted, and have a general course or strike on the Cash lands of about North 25° East and South 25° West.

The ores are opened near a small nameless branch of Irish creek. Opening No. 1 is some 40 to 50 feet above the level of the run. The trench, as dug, is in two lines that meet in an angle of about 120°.

The crystaline rocks here are nearly vertical and consist for the most part of quartz, feldspar (orthoclase and albite) hornblende, and, at a few points, mica schist. The tin vein apparently cuts across the rock measures for 30 feet of the trench and then follows up the rock beding to the surface.

The tin vein could only be seen in the part which runs up to the surface and for some ten feet of the vein course nearest thereto; part of it had been covered up with rock taken out in mining. The vein exposed and examined showed a well defined vein, with regular walls, the vein at times being made up of nearly pure tin ore and again partly or entirely replacing the tin ore with white quartz. The vein, however, kept its true course however much the quartz cut in.

The surrounding rock held some small lenticular masses of tin ore, but seemed usually to be only slightly impregnated therewith.

An analysis of samples selected by Mr. Rittenhouse, representing all grades from pure tin crystals to quartz and rock holding little or no tin, showed by duplicate tests 31.76 and 31.44 per cent metalic tin, being an average of 31.60 per cent. While this will probably represent fairly enough the average of the ore already mined, there is a good deal of vein matter which will yield much better, perhaps 70 per cent and over. The largest piece of ore of this kind that we saw was not over two inches in thickness, and much of it was not more than one inch in thickness.

Opening No. 2 is some 700 yards on the North 25° East and South 25° West course from No. 1. The ground shows numerous float specimens containing more or less tin. On this hill, 2,700 feet above tide (No. 1 being 2,450) they have shafted and have started a trench, but as yet have found no vein of tin ore. We judge from the rocks that they are not at the same horizon as No. 1.

It is reported that Mr. Hurlburt has opened a seven inch vein some 5 miles further down Irish creek, but we could obtain no reliable information about it and did not visit it.

Judging from the previous statement of facts ws are of opinion:

1. That the amount of high grade tin ore shown in place is sufficient to justify keeping this tin ore deposit under consideration, and giving it in the future any needed field examination.

2. The owners are now unduly excited over the prospective value of their property. The prospecting is not judiciously conducted, and it will cost them much to show but little.

We have not deemed it necessary to enter into the question of mining cost, hauling charges, cost of smelting, value of graded ores, market for block tin and general review of tin deposits, these questions belonging to a detailed report on the availability of a tin ore bearing region rather than to a mere preliminary report which is simply to judge whether the question is worth enquiring into as to these tin ore deposits.

Tin Ore in the Blue Ridge, in Virginia.

Maj. Jed Hotchkiss:

Dear Sir:—It has been my privilege to visit the tin mine recently opened in the eastern corner of Rockbridge county, Virginia. Thinking it may be interesting to some of your scientific readers, I will give you a short account of its history.

For some years past there has been a rumor abroad that tin ore had been found on Irish creek, in this county. Specimens were brought to the laboratory of Washington and Lee University to be tested, but no tin was found in them. About one year ago Mrs. Martha Cash found a heavy piece of brown ore along the path to her spring. She carried it home with her, but little was thought of it until last May, when she happened to show it to some one who thought it was tin ore. This renewed the old fever, and search was at once started for the long sought treasure near where she had found this small piece. The result was that several other specimens were found, which proved to be the ore sought. Arrangements were soon made by Mr. Cash to have the matter more thoroughly investigated.

Since about the first of August work has been going on with more or less regularity, and a considerable amount of tin ore has been mined.

Reports that were circulated were contradicted, because they were thought to be the offspring of the old rumor. My attention was called more closely to the question by being presented with a piece of beautiful binoxide of tin by Capt. Z. H. Rawlings. I immediately made up my mind to visit the locality from which the ore was said to have been brought. On reaching it I found the mine to be on Painter Mountain branch of Irish creek, about one mile and a quarter from the line of Nelson county.

The ore is found in a vein runing east and west. The country rock is that which makes up the axis of the Blue Ridge range—commonly supposed to be aqueo-igneous. It consists principally of large crystals of quartz and feldspar and smaller crystals of hornblende.

Immediately associated with the ore is a vein of quartz several inches thick, lying to the north. To the south and between some of the crystals of the ore we found mica in the form of little yellow scales, appearing in irregular seams imbeded in the country rock. Small crystals of iron pyrites also occur associated with the mica and clinging to the back of many of the crystals of ore.

The ore is the variety known as *Cassiterite*, or Binoxide of Tin. I analyzed a specimen of it, that I broke from the vein, with the following result;

Metalic tin,	63.583
Metalic iron,	1.680
Silica,	8.415
Sulphur,	0.066
Arsenic,	0.301
Titanium	distinct trace.

It had other constituents not yet determined.

At some future time I may give you a more detailed account of this important discovery, and touch more upon its geological position and surroundings.

Yours very truly,

Harry D. Campbell.

Washington & Lee University,
Lexington, Va., Oct. 23d, 1883.

The Valley Railroad of Baltimore & Ohio RR.

One of the most interesting events of this month to the state of Virginia is the completion and opening of the Valley Railroad between Staunton and Lexington, a distance of 36 miles. This gives to the Baltimore & Ohio system a line of railway for 162 miles, from Harpers Ferry to Lexington, along the central portion of the length of the great Valley of Virginia, or about half the entire length of that famous agricultural, pastoral, forestal and mineral region. From Harpers Ferry to near Raphine (the station for the village of Midway or Steele's Tavern), a distance of about 142 miles, it traverses the entire length of the renowned Valley of the Shenandoah, a portion of the Valley of Virginia, ascending from 272 feet above tide to over 1,800; it then passes into the basin of James river and descends to an altitude of about 900 feet, where it joins the Richmond & Alleghany RR. on the bank of North river of the James near Lexington.

In pursuance of our plan, on the opening of new railways in the Virginias, we give below the stations of the Valley Railroad, the counties in which they are located, the distances between them and the distance of each from Harpers Ferry, (where this branch joins the main line of the Baltimore & Ohio RR.), and the elevation in feet above tide of the grade at each station.—The information northeast of Staunton is drawn from Hotchkiss' Summary of Virginia, p. 258; that southwest from Staunton was kindly furnished *The Virginias* by Thomas R. Booth, the railway engineer last in charge of the construction of this extension:

Stations.	County and State.	Miles between Stations.	Miles from Harpers Ferry.	Feet above tide.
Harpers Ferry,	Jefferson, W. Va.	0.0	0.0	277
Millville,	" "	3.5	3.5	....
Halltown,	" "	2.5	6.0	339
Charlestown,	" "	4.0	10.0	513
Aldridge,	" "	3.5	13.5	547
Summit Point,	" "	4.5	18.0	623
Wadesville,	Clarke, Va.	4.5	22 5	495
Stephenson,	Frederick, Va.	4.5	27.0	499
Winchester	" "	5.0	32.0	717
Kernstown,	" "	3.7	35.7	744
Stephens City	" "	3.5	39.2	731
Middletown,	" "	4.8	44.0	669
Cedar Creek,	" "	2.0	46.0	591
Capon Road,	Shenandoah Va.	4.0	50.0	701
Strasburg Junction,	"	1.0	51.0	663
Strasburg,	" "	1.0	52.0	637
Toms Brook,	" "	4.3	55.3	745
Maurertown,	" "	1.8	57.1	788
Woodstock,	" "	4.2	61.3	829
Narrow Passage Bridge,	" "	....	.....	858
Edinburg,	" "	5.0	66.3	845
Mt. Jackson	" "	7.5	73.8	916
Quicksburg,	" "	3.3	77.1	953
New Market sn.,	" "	4.0	81.1	971
Timberville,	Rockingham, Va.	4.0	85.1	1,018
Broadway,	" "	2.5	87.6	1,038
Cowan,	" "	2.5	90.1	1,107
Linville,	" "	3.8	93,9	1,212
Harrisonburg,	" "	6.2	100.1	1,338
Pleasant Valley,	" "	4.8	104.9	1,248
Mt. Crawford,	" "	3.0	107.9	1,171
Weyers Cave sn.,	Augusta, Va.	4.3	112.2	1,152
Mt. Sidney,	" "	3.0	115.2	1,258
Fort Defiance,	" "	1.3	116.7	1,247
Verona	" "	3.8	120.5	1,272
Staunton,	" "	5.5	126.0	1,365
Muddy Lane,	" "	5.5	131.5	1,488
Mint Spring,	" "	1.6	133.1	1,562
Greenville,	" "	5.0	138.1	1,598
Raphine,	Rockbridge, Va.	6.4	144.5	1,855
Summit,	" "	1.4	145.9	1,930
Fairfield,	" "	4.5	150.4	1,714
Gibson.	" "	4.1	154 5	1,422
R. & A. Junction,	" "	6.1	160.6	904
Lexington,	" "	1.5	162.1	1,023

Note.—Aldridge was formerly known as Cameron, Stephens City as Newtown or Newtown-Stephensburg, and Quicksburg as Forest.

Of the new stations, beyond Staunton, Muddy Lane is near the crossing of Mill creek; Mint Spring, Greenville and Fairfield are stations nearest the villages so named. Raphine, the station near Midway, is named from the farm of Mr. J. E. A. Gibbs, of the Wilcox & Gibbs Sewing Machine Co., a name derived, says Mr. Gibbs, from the Greek for sewing machine. Gibson is the station nearest old Timber Ridge church; the junction with Richmond & Alleghany RR. is on the east bank of North river, 1½ miles east from the station in Lexington.

Physical properties of coke, &c.—We note in the reports of the proceedings of the Am. Institute of Mining Engineers at its recent meeting in Troy, N. Y., that Mr. John Fulton, mining engineer of the Cambria Iron Co., read a paper on "The physical properties of coke as a fuel for blast-furnace uses,"—a sort of rebutal, as the lawyers would say, of the paper of Prof. Dewey, read at the Roanoke, Va. meeting, an abstract of which we published.

The Engineering and Mining Journal, of New York, says of this paper: "Mr. Fulton goes over the ground traversed in recent publications in a controversy between the Connellsville *Courier* and *The Virginias*, and adds a few data confirming former researches, but on the whole his paper contains little that has not been touched upon in them."

When the full text of this paper comes to hand we will give our readers any new points it may contain. Mr. Fulton has given much thoughtful attention to the manufacture of coke, and his observations are well entitled to respectful and careful consideration. At the same time we do not concede that he has made out his case that Connellsville coke is superior to all others for metalurgical purposes. The makers of that coke have had the advantage of years of experience in a large production from one bed and kind of coal coal, and they have learned to make a first rate coke. When New River coke manufacturers have had similar experiences and have learned to know their coal, and the best way to coke it, we have no doubt but that they will uniformly produce not only as good an article, in all respects, as is made at Connellsville, but, of necessity, from *having a purer coal to operate with*, one that, in some important particulars, is better.—We are now using some Connellsville coke in Virginia, not because it is prefered to Virginia coke, but because the demands of our blast-furnaces have outrun the producing capacity of our existing coke-works; and this leads us to say that the best inducements for enterprise and capital that we now know of, are to be found in the construction and operation of coke works on the cheap coking coal lands of the New River basin, on the Cheasapeake & Ohio and the Norfolk & Western railways, to supply this demand for a superior article of coke.

The Ches., Ohio & Southwestern Ry., by its completion from Louisville to Memphis, has just opened up, almost at our very doors, a land-locked harbor that ranks among the great harbors of the world, like that of the Amazon, and midway of our Atlantic coast-line, hundreds of miles nearer us than New York, and in direct communication with Europe by lines of ocean steamers built and being built. We are now nearer neighbors to the brave old town of Richmond, destined within the next generation to become the rival of Bristol, Eng., in manufactures, and Glasgow, Scotland, in shipbuilding. If we look at what Richmond has achieved in the last fifteen years, we will be encouraged to renewed effort.—*Memphis, Tenn., Appeal.*

The Union Steamship Line.

One of the most important of the events of this month, in so far as the interests of Virginia and West Virginia—and in fact of the states south and west of them—are concerned, was the arrival at Newport News, on Wednesday, Oct. 3, 1883, of the steamship Arab of the Union SS. Line, from Liverpool, England, by way of the Azores and the Bermudas,—the old mild weather route to Virginia when she was the leading importing and exporting colony of America.

The Arab is the pioneer of a line of ocean steamships that for the present will make regular monthly trips between Liverpool and Newport News and Norfolk, Virginia, by the ocean highway followed by the Arab.—The following extracts from an account given in "The State," of Richmond, Va., of a reception and lunch given to prominent citizens of Richmond and Norfolk on board the Arab by its captain, Henry O. Wise and Mr. Maynard, one of the directors of the Union SS. Co. (limited.), will give our readers a good idea of what this steamship company is, what it has done, and what it proposes to do for Virginia and the states naturally tributary to its great continental harbor and the cities thereon that are daily growing in commercial importance,—mainly in consequence of the great railway lines, notably the Chesapeake & Ohio and the Norfolk & Western, that connect them with the vast resources and great and rapidly increasing populations of all the interior states of the Union.

"*The Arab* is the second largest ship of this line, and is of about 3,500 tons burthen, there being very little difference between her and the large Cunarders. She is commanded by Capt. Henry O. Wise, and formerly ran to the Cape of Good Hope, a route which requires stout ships and good sailors. In outward appearance and passenger capacity there is but little difference between the Arab and the steamships of the Cunard, Inman and other lines. She is a first-class vessel, and after the inspection yesterday she was found to excel the vessels of these lines in one very important particular; that is in the size of her state-rooms, which a number of the visitors who had crossed in the ships of these other lines testified were much larger and more comfortable and airy than those found on any of the northern lines. The officers were polite and attentive to the visitors, and guided them over the monster vessel, by the side of which steamships at Richmond wharves look like mere canoes. She was well provendered, and such of the visitors as wished to compare English sheep and English fowls with American had ample opportunity to do so, as the pens on the Arab were well filled with fine specimens.

After the meal, when the Captain had been toasted, Mr. Maynard rose, and in a concise speech gave a history of the Union Steamship line. He expressed regret that the honorable president of the Board of Directors of the company was unable to be present at this gathering, as he was prevented by his duties as member of Parliament. Mr. Maynard said doubtless the first question that would be asked was: "Who are you; and what do you want?" In reply he would say that this company begining twenty years ago with two small vessels now has twenty, the largest being 4,500 tons. They claimed for their ships that while they were in every respect as good as any others, they were entitled to special credit for safety, reliability and size of state-rooms. He was especially gratified at meeting the business men of Richmond and Norfolk, and with their co-operation he was sure that the pioneer venture would succeed. If the line was encouraged, other vessels would be rapidly put on. The company had more ships than tonnage was furnished for, and in looking around for new fields, after careful investigation, they had come to the conclusion that this was a fine one. All they asked was that their American friends will meet them half way in their efforts to build up a trade that would be mutally beneficial.

Mr. Maynard said the first trip over had been very satisfactory. The vessel had heavy head winds to contend against all the way. She left Liverpool September 15th and went to St. Michaels of the Azores, where they spent nine hours; thence to Fayal, where they remained twenty-one hours; then to Bermuda, where they stayed thirty hours, and from thence they came to Newport News. He thought St. Michaels offered a fine field for emigration, and the company had much hope of bringing by this line a large number of emigrants. As to Bermuda, he thought this ought to be a charming place at certain seasons of the year, and now that it would be made easy of access by this line he thought that a good many passengers would avail themselves of the opportunity. Mr. Dyson Weston, the Liverpool agent of the company, was called on, he made a few remarks, promising that the company would do all in its power to make the enterprise successful.

The Arab brought over 26 passengers, 9,600 sacks of Liverpool salt, 150 tons of cotton ties and 65 barrels of ginger ale and brown stout. A large quantity of the salt was for Davenport & Morris, of Richmond. Among the passengers was an English gentleman of fortune and leisure, who came over to judge for himself of the advantages of the new route. He was enthusiastic upon the subject, and considered this route so much more attractive than the northern line that he determined to go back by it. Of the passengers 19 were first-class. One of them went at once to the White Sulphur Springs. Eight or ten went to North Carolina, and several to Charleston, S. C. All expressed themselves as delighted with the Arab, her officers and the trip.

This effort at establishing direct trade between Newport News and Liverpool marks an auspicious era in our commercial history. The Union SS. line is one of the largest corporations in the world, and has liberal means to back its enterprises. They have seen a fine opening, and are willing to invest their capital and await results. They want encouragement from our people, and if they are encouraged the line will be a great factor in building up Richmond and all sections of the state. The Chesapeake & Ohio and its connections passes through the richest agricultural and mineral sections of the United States, and controls especially the states which produce those important staples, wheat and tobacco, and is contiguous to the great cotton districts.

It is this vast commerce that the Union steamship line wishes to develop, and it will give these sections the cheapest and safest outlet for their products and manufactures

Mr. Richmond Lewis, of the Richmond Canning Company, will send over by the Arab a large assortment of canned goods to a Liverpool house. This canning company proposes to remove its canning establishment to Newport News in order to have better facilities for canning oysters and crabs.

When the Arab leaves Newport News another of the company's steamships leaves Liverpool. The line will for the present be monthly. The Steamers will stop at the Bermudas and the Azores going out, but not on the return trip.

Not only for freight, but to American passengers especially, this route offers great attractions, and it will be known as *the great southern route*. Its advantages over the northern are, no danger of fogs or icebergs, and that the monotony of travel on the sea is broken. For instance, after sailing three days from Newport News passengers reach the Bermudas. Here they will remain two days and can visit this interesting tropical country. Then sailing four days more they will reach the Azores islands, where another day or two will be spent amid new and strange scenes. Then in

three or four days they reach Liverpool. In this way the hitherto long and unbroken voyage across the Atlantic is varied by visits to new and strange lands with their rich luxuriance of tropical scenery. One of the visitors to the ship yesterday was so much pleased with the variety thus given to the hitherto unvaried trip across the ocean that he announced his intention of going across next summer on the Arab instead of taking the tiresome northern trip. The company has the ships, and will put others on the line as rapidly as the business justifies it. We hope that it may not be long before their steamers will leave Newport News twice a month for Liverpool.

Newport News is now in condition to handle the immense business which can be brought to it. The Chesapeake & Ohio company's elevator there is next to the largest in the world, there being one in Milwaukee a little larger. No idea of the immense size of the structure can be gained until one stands near and looks up at it. The great piers, runing far out, have every facility for loading and unloading vessels.

The Hotel Warwick is probably the finest equiped hotel in the south; Richmond has nothing that can compare with it, and the wish was very generally expressed that it could be transplanted here. Our citizens, indeed, can form little idea of the immense strides of progress made at this great harbor, nor what the Chesapeake & Ohio is doing in the way of building it up. Preparations on this scale indicate that far-sighted men would not put such an immense amount of capital in an enterprise unless they saw beyond the risk a realization of their expectations.

From all this Richmond is to reap no little benefit if her merchants take hold of the opportunity. One great object of the line is to bring emigrants over to this country and settle them along the line of the Chesapeake & Ohio railway. Virginia will get a good share of them. At the same time it will offer Richmond business men an opportunity of dealing directly with Liverpool.

Immigration.—We find the following sensible remarks on the subject of immigration in the Princeton, W. Va., Journal of Sept. 20, 1883. We endorse its sentiments and its statements. The great Flat-top coal-field occupies a large area in Mercer county:

We want none of the people to come among us to make homes with us, whose departure is not regreted by the people among whom they have lived. It is natural and right for us to cling to our old friends and neighbors and wish them to remain with us; but when they become fugitives from justice they are not wanted or welcome anywhere. Not one of our citizens who has lands to sell or houses to rent can, as a good citizen himself, or in justice to himself, his family, or the community in which he lives, give such men an abiding place.

We want, and must have, if we are to build up our schools, churches, and all the laudable enterprises and interests that are necessary factors in securing the prosperity of our country and state, more people to aid in clearing out our lands, in making roads, and in building up the social and material interests of the country. To such men we extend a hearty welcome. We will sell or rent them our houses or lands and cheerfully extend to them all the encouragement and material aid and assistance that we are able to give. We have a vast area of land in Mercer county that ought to be under cultivation, and we invite capital, energy and the intelligence of other sections to come and make their homes with us. The possibilities of this region have not been conceived of in the minds of our people. Our timber, coal, iron, limestone, and, above all, our fine wheat and grass growing lands, compare favorably with any in the state; they only want to be intelligently operated and cultivated to make Mercer the richest county in West Virginia, and her people the most independent people in the world.

Coal and Coke Traffic, Ches. & Ohio Ry., Sept. 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during Sept., 1883, and Sept., 1882, in tons of 2,000 lbs., compiled by fuel agent, C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	810	1,760	....	950
Gas	23,606	34,018	....	10,412
Splint and block	8,103	12,018	....	3,915
New River, &c	30,769	34,115	....	3,346
Coke	6,873	7,646	....	773
Totals	70,161	89,557	....	19,396

This movement for September, 1883, shows a net decrease of 19,396 tons compared with the movement for September, 1882; a decrease shared in by all the kinds of fuel transported.

The distribution of the above was as follows;

	1883.	1882.
1. To Ches. & Ohio Co. for its own use	19,090	18,584
2. To Huntington, for West via Ohio river	.....	3,043
3. On Elizabethtown, Lexington & Big Sandy RR.	3,997	4,678
4. On Ches. & Ohio Ry., excepting Richmond.	15,657	10,912
5 To Richmond & Alleghany RR. at Clifton Forge.	2,176	259
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	16
7. To Shenandoah Valley RR. at Waynesboro	40	2,154
8. To Va. Midland Ry. { At Charlottesville	4,677	5,918
8. To Va. Midland Ry. { At Gordonsville	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR. Junc.	466	377
10. To Richmond for consumption including tugs, &c	7,159	8,870
11. To James River wharves for shipment	8,313	16,257
12 To Newport News { Consump'n includ'g tugs &c,	1,456	3,185
12 To Newport News { For shipment	7,130	15,304
Totals	70,161	89,557

This shows a very large and continued increase in the deliveries of coal on the line of this railway west of Richmond; a consequence of the great and continuing activity in the manufacture of iron now prevailing along this railway.

The total movement from January 1st to September 30th, for the years 1883 and 1882, was as follows:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	20,514	22,986	.....	2,472
Gas	273,160	251,732	21,428	.....
Splint and block	75,671	98,254	.....	22,583
New River, &c	301,004	266,313	34,691	.....
Coke	77,834	67,673	10,161	.....
Totals	748,183	706,958	66,280	25,055

This shows a net increase of 41,225 tons, or nearly 6 per cent, in the yearly movement of 1883 over that for 1882 up to September 30th.

We learn, from the dealers in C. & O. coals and cokes in the great markets and from the miners and shipers along the railway that the decreasing traffic shown in these reports is not in consequence of a decrease in the demand for the superior gas, steam and domestic coals of this region, but a result of their inability to secure transportation from the mines.—It is greatly to be regreted that such a condition of things exists in a coal-field of such exceptional excelence, and we hope the railway authorities may soon be able to remedy it.

Notes on the Geology of West Virginia.

Written for *The Virginias* by Prof. I. C. White.

(Continued from page 143.)

No. VII. The Geology of the Ohio river from Marietta to Point Pleasant at the mouth of the Great Kanawha.

Below the mouth of the Muskingum river, the hills become once more abrupt on the Ohio side, and one mile and a quarter from Marietta the following succession (Sec. 19) was obtained in descending from the summit of a steep hill:

1.	Concealed	30′
2.	Sandstone, massive	30′
3.	Concealed	20′
4.	Sandy shales and flagy sandstone	12′
5.	Sandstone, very massive, quarries	43′
6.	Variegated shales	10′
7.	Concealed and sandy shales	70′
8.	Variegated shale	5′
9.	Concealed to low water in Ohio river	90′
	Total	310′

The upper half of this section certainly belongs in the *Permo-carboniferous*, and possibly all of it, since no *coal* whatever was seen in the whole 310 feet. As stated in a previous paper, we did not keep hold of the rocks from St. Marys to Marietta across the "Oil Break" axis, for the reason that exposures are poor along the river, and we could not spare the time to carry the section across the country back from the stream, hence in the absence of all characteristic rocks from the section just given, there is much uncertainty as to its exact place in the series, though I am inclined to believe that No. 5 represents the *Middle Proctor sandstone*, or the one which occurs 50′–60′ above the *Washington coal*, in Sec. 13, at Raven Rock.

About one mile below the locality of the last section, the Lake Huron Stone Co. has extensive Grindstone quarries on the Ohio side of the river, and in descending the steep bluff at that point, Sec. 20 exhibits the following:

1.	Sandstone, grayish white, massive, quarried for grindstones	45′
2.	Concealed and red marly shale	30′
3.	Gray sandy shale	10′
4.	Sandstone, massive, grayish white, quarried for grindstones	45′
5.	Shale	3′
6.	*Coal*, impure	1′
7	Concealed	60′
8.	Coarse, massive sandstone to low water in Ohio river	15′
	Total	209′

Concerning the identity of coal No. 6 there is much reason for uncertainty. The late Prof. E. B. Andrews termed it the *Hobson coal*, and regarded its place in the series as about 200′ above the *Pittsburg bed*. In our work along the Ohio no coal bed has been seen at 200′ above the Pittsburg seam, but a bed (the *Waynesburg*) comes at 240′–260′ above the latter coal, and another, (*the Washington*) at 100′–120′ higher. It is possible that the little coal in the preceding section may represent one of these latter beds, and if so, the probabilities are in favor of its being identical with the *Waynesburg bed*, since the *Washington coal* has never been seen with a massive sandstone for its roof, while this feature is almost universally present with the *Waynesburg seam*.

The Lake Huron Stone Co. has large quarries in the sandstones Nos. 1 and 4, from which grindstones are manufactured, and extensively shiped, principally for use in cutlery works.

Beyond the locality of the last section the Ohio river veers southward, and finally flows about due south to Parkersburg, at the mouth of Little Kanawha river, 12 miles below Marietta. In the last 10 miles of this distance no sections were obtained, since the exposures are not good, and the hills retreat from the river.

The following succession was observed at Parkersburg in descending from the Jackson Stone quarry, on the Northwestern Turnpike, to the Ohio river, (Sec. 21.)

1.	Concealed from the top of a terrace, containing rounded pebble sand boulders	40′
2.	Sandy shales	10′
3.	Sandstone, (*Upper Proctor*) quarried for building purposes	25′
4.	Concealed and deep red with scattering limestone nugggets	15′
5.	Concealed	80′
6.	*Coal* (*Washington*) reported as one foot thick at low water in the Ohio	1′

The rocks of this section are the first we have found in the Ohio river hills below St. Marys, in Pleasants county, 30 miles above Parkersburg, about whose identity there has not been much doubt. Here, however, our uncertainty ends, since from Parkersburg, southward, we succed in keeping safely hold of the rocks until the *Pittsburg coal* comes up again Hartford City. It is in consequence of this southward tracing of the strata that the identifications in this section are regarded as trustworthy.

The Upper Proctor sandstone, No. 3, is a yellowish gray, micaceous, and somewhat feldspathic rock. Owing to its presence within the corporation limits, and the facility with which it can be quarried and dressed into blocks of any desirable size, it has unfortunately been largely employed in the construction of Parkersburg buildings. That it is entirely unfited for such purposes anyone can determine for himself by observing the rapidity with which it weathers away on all exposed surfaces. This is due principally to the large quantity of disseminated feldspathic material which it contains, since the chemical action of the air and water on this, breaks up the coherence of the sand grains, and causes the rock to waste gradually away. It should never be used in any portion of a building exposed to the elements, for its rapid rate of decay will in a few decades, at most, ensure the destruction of any fabric into whose construction it has entered.

The Washington coal, No. 6, was not seen, being submerged by 6′–8′ of water at the time of our visit to Parkersburg, but we learned from reliable sources that it exists in the position assigned and can be seen at low water. This identification being correct, the horizon of the *Pittsburg coal* should be found at about 360′ below the level of the Ohio river at Parkersburg. The probabilities are, however, that the *Pittsburg coal* is absent, as a workable bed, in the vicinity of Parkersburg, since it is absent where its horizon is elevated to daylight in the "oil break" at Burning Spaings and other localities along that line only a few miles from the mouth of the Little Kanawha. Certainly no shaft should ever be sunk for it at Parkersburg without first testing its presence with the drill. Just below Parkersburg some one has already sunk a shaft to the depth of nearly 100′ in search of coal without having drilled any test holes, so far as we could learn. It is needless to state that such methods of exploration are very unwise, to say the least, in a region where no coal of workable value is likely to be found until a shaft has been sunk to the *Lower Coal measures*, the top of which cannot well be less than 800′ below the level of the Ohio at Parkersburg; and if Mr. F. W. Minshall's identifications be correct, it would be 1,100′ to the top of the *Lower Coal measures*. This gentleman has given considerable attention to the local geology at Parkersburg and vicinity, and he finds reason for believing that the *Pittsburg coal horizon* underlies the Ohio river at Parkersburg at a depth of

640', instead of 360' as determined by my identifications. That Mr. Minshall is in error is rendered certain, not only by our tracing of the rocks from Parkersburg southward, but also by the fact that if the *Pittsburg coal* horizon was indeed 640' below the Ohio here, then *Limestone X* should be found in the Parkersburg hills at an elevation of little more than 100' above the river, whereas it is not found until we pass 3–4 miles back into the country and at an elevation not less than 400' above the river, which is just where it ought to come if the little coal, No. 6, is the *Washington*, since this limestone is always found at about 400' above the latter coal, being exactly that on the Ohio river at New Martinsville in Wetzel county. (See Sec. 10.)

Just across the Little Kanawha river from Parkersburg the following Section (22) was obtained in descending a steep hill from the site of old Fort Boreman:

1. Sandy shales from top of hill	10'
2 Sandstone, gray, rather massive	25'
3. *Red shale*, and concealed	45'
4. Sandstone, brown, massive	20'
5. *Red*, marly shales, shaly sandstone and concealed, with red shale at base	95'
6. Concealed to low water in Ohio river	95'

Here the *Upper Proctor sandstone*, which is such a conspicuous member of the former section, has thined away to so great an extent as to be scarcely recognizable, though a stratum of sandstone in No. 5, whose base comes 125' above the river, appears to be its equivalent. It is only 10'–15' thick however, and not very massive.

As we pass down the Ohio river from Parkersburg, a bed of massive, pebbly sandstone soon makes its appearance above water level, and is constantly in sight for many miles below.

One mile below the lower end of Blennerhasset island, the following succession was observed on the Ohio side. (Sec. 23):

1. Concealed from top of knob	100'
2. Sandstone, yellowish brown, flagy	10'
3, Concealed	10'
4. *Deep red shale*	20'
5 Sandstone, flagy	5'
6. Concealed, and shales	30'
7. *Red shale*	5'
8. *Coal, blossom. Washington*	—
9. Concealed and shales	15'
10 Sandy shale and flagy sandstone	10'
11. *Sandstone, Waynesburg.* massive, pebbly, visible	20'
12. Concealed to low water in Ohio river	45
Total	270'

No. 8 is the little coal which makes its appearance near water level at Parkersburg and which we have there identified with the *Washington bed.* Its position here at 90' above low water would place the horizon of the *Pittsburg coal* 250'–275' below river level, though the coal itself is doubtless absent as a workable bed.

No. 11, the *Waynesburg sandstone*, is the massive, pebbly rock which rises from the river a short distance below Parkersburg, and with but slight interruptions, is constantly seen as a great cliff along the river hills for nearly 50 miles. It is quite pebbly in streaks, some of the quartz pebbles being an inch in diameter, and the stratum sometimes attains a thickness of nearly 100'. This great pebbly sandrock is quite soft and coarse, and seldom furnishes any good building stone.

At Murraysville, in Jackson county, 25 miles below Parkersburg, this great cliff-rock rises to 120' above the Ohio, and a thin *coal* (Waynesburg) is reported under it here, as well as on the Ohio side near Long Bottom.

A well was once drilled for oil to a depth of several hundred feet, just below Long Bottom, begining about 45' above the Ohio river. In this boring a thick (12') bed of coal is reported to have been passed through somewhere between 250 and 290 feet. This would come at the proper horizon for the *Pittsburg bed*, and, if the report be true, would show that this important stratum has again made its appearance in the river after having been absent along the Ohio from the vicinity of St. Marys to several miles, at least, below Parkersburg, or a distance of probably 50 miles. From Murraysville, southward, however, this coal, of workable thickness, has frequently been struck in borings, and this territory along the Ohio from Long Bottom to Hartford City, where the coal first rises to day, is very probably all underlaid by this valuable bed. However, as already stated, no shaft should be sunk for it without first proving its presence with the drill, for it may possibly be absent at some localities.

Near the mouth of Skill run, and about six miles below Murraysville, the following Section (24) was taken in descending a steep hill:

1. Massive sandstone from top of knob	25'
2. *Deep red shale*	35'
3. Concealed red shale	30'
4. Sandstone, massive	20'
5. Concealed	15'
6. *Red shale*	10'
7. Shale, gray, sandy	5'
8. Sandstone, massive	5'
9. Sandy shales and concealed	70'
10. *Red shale*	10'
11. Sandstone, flagy	25'
12. Sandstones, coarse, yellowish-gray, micaceous, pebbly near base, (Waynesburg)	30'
13. Concealed to low water in the Ohio river	70'
Total	350'

This section all belongs to the *Permian*, or *Permo-Carboniferous series*, except the basal member, No. 13, which comes in the *Upper Coal measures*, and thus the horizon of the *Pittsburg bed* would be not far from 200' below the river at this point, though whether it be present in a workable vein, or otherwise, nothing but the drill can determine.

As we pass south from the vicinity of the last section the rocks dip under the river and the *Waynesburg sandstone* approaches water level, so that at Ravenswood, 6 miles below the mouth of Skill run, that stratum floors the bed of the Ohio.

Just opposite Ravenswood, and about 40' above the Ohio river, an attempt has been made to open a coal mine. No coal was seen at the drift, but it was reported to us that a bed of coal one and a half foot thick was encountered a few feet from the mouth of the entry on the top of a thin bed of fire-clay. This would be the representative of the *Washington coal*, and would show that the *Pittsburg coal* horizon underlies the Ohio river at Ravenswood at a depth of not less than 300 feet.

A limestone is reported as occuring in the summits of the hills one mile east from Ravenswood, and at an elevation of 350'–400' above the Ohio. This would most probably be *Limestone X*, which which we found in the summits of the hills at New Martinsville, and 750' above the *Pittsburg coal.*

This latter coal seems to be present here as a valuable bed, if the reports of a boring made for oil, one mile below Ravenswood, can be relied upon; since in this well a bed of coal, 7' thick, was reported at a depth of 300', the mouth of

the well being on the river bank about 30′ feet above the water.

Two miles below Ripley Landing, and about 9 miles below Ravenswood, the following succession (Sec. 25) was observed in descending a steep hill on the W. Va. side of the Ohio.

1.	Concealed from top of knob	20′
2.	Sandstone, making bluff	19′
3.	Sandy shales and concealed	50′
3.	Red shales, mostly with sandstone at base	40′
5.	Concealed	35′
6.	Sandstone, and sandy shales	25′
7.	Concealed	15′
8.	Flagy sandstone and concealed	30′
9.	Sandstone and shales	20′
10.	Concealed	20′
11.	Flagy sandstone	10′
12.	Concealed to low water in Ohio river	45′
	Total	320′

This section is near the middle of the great southward bend which the Ohio river makes between Murraysville and Pomeroy, and only one mile above Letart Falls. Unfortunately the section here gives no information as to the geological horizon of the rocks along the river, but it seems most probable that the *Waynesburg sandstone* is at or below water level, since the rapids at Letart Falls appear to be due to the emergence of this massive sandstone from the bed of the Ohio just as that river turns northward after its long sweep to the south. If this identification of the Letart Falls sandstone with the *Washington bed* be correct, it would follow that the horizon of the *Pittsburg coal* must be 250′—300′ below the Ohio in the center of the great bend in that stream near Letart Falls.

From this last locality (Letart Falls) the Ohio river flows nearly due north, and, as a result, the rocks rise rapidly from beneath its bed, bringing the *Pittsburg coal* up to within 130′ of the surface of the river at Antique, opposite the mouth of West creek, 6 miles north from Letart Falls.

One mile above Antique the following Section (26) was observed in descending a steep hill to the Ohio river:

1.	Red and variegated shale	30′
2.	Sandstone, massive	20′
3	Red shale and concealed	30′
4.	Coarse, massive pebbly sandstone (Waynesburg)	30′
5.	Sandy shales	10′
6	Concealed	90′
7.	Massive sandstone to low water	15′

This section would show that the *Pittsburg coal* underlies the river here at a depth of something like 140 feet.

At Antique, Ohio, this coal has long been mined by a shaft 190′ deep, which exhibits the following succession (Sec. 27) as given by the late Prof. E. B. Andrews, in his report on Meigs county, Ohio survey, vol. 1, page 258:

1.	Top of shaft to low water of Ohio river	62′
2.	From low water to top of heavy sand-rock	50′
3.	Heavy sand-rock, (Pittsburg sandstone)	70′
4.	Shale with coal plants	10′
5.	*Coal*, Pittsburg or Pomeroy seam — Coal 2′5″, Slate 0′1″, Coal 3′3″	5′9″
6.	Hard fine grained sandstone	12′
7.	Fireclay	5′
	Total	215′

My measurements here differed somewhat from the above section, but not enough to be of any importance. By barometer I got the following in descending the shaft from the base of the hill above. (Sec. 28):

1.	Sandstone, massive, pebbly, *Waynesburg*	40′
2.	Concealed	60′
3.	Concealed in shaft to low water in Ohio	70′
4.	Interval to coal	110′
5.	*Coal*, *Pittsburg* — Coal 2′6″, Slate 0′2″, Coal 3′0″	5′8″
	Total	286′

The employees at the coal works told us that the shaft was 190′ deep to a point which passes 5′ below the base of the coal, and as our barometric measurement agrees exactly with this statement, it seems probable that Prof. Andrews' section makes the coal a few feet further below river level than it should be. By his section the interval from the *Waynesburg sandstone* to the *Pittsburg coal* is 252′, and by mine 240′; so the difference is only 12 feet

The coal at this locality is of very fair quality, coming out in large, solid blocks which exhibit only a small quantity of pyrites.

The bluish shales which form the roof of the seam contain some beautiful *fossil ferns*, among which *Neuropteris hirsuta*, *N. Loschii*, *N auriculata*, *Pecopteris arborescens*, and *P. dentata* are most abundant.

This is the first locality on the Ohio river below Pipe creek (Sec. 4), 160 miles above Antique, where the *Pittsburg coal* has been mined, though as our sections, Nos. 5–25, have shown, there are numerous localities at which it could be reached, if present, with shafts of moderate depths, there being only a few spots where the depth, would exceed 300 feet.

An interesting fact shown by the last sections is that the interval from the base of the *Waynesburg sandstone* to the *Pittsburg coal* has the same thickness (240–250 feet) here, as at Wheeling, Pipe creek, and other points along the upper Ohio, though the several *coal beds*, (*Waynesburg*, *Sewickley*, and *Redstone*) there represented, have disappeared entirely from the Upper Coal measures at Antique. These sections also establish another interesting point, viz: that the massive, pebbly sandstone which rises from the bed of the Ohio a short distance below Parkersburg, and which with but slight interruptions we traced from that point to Antique, where it appears as No. 1 of Sec. 28, was correctly identified as the *Waynesburg sandstone.*

About one mile below Syracuse, and 6 miles below Antique, the *Pittsburg coal* rises above the water level on the W. Va. side of the river, and in descending a steep hill there the following (Sec. 29) succession was observed:

1.	Sandstone, quite massive, *Waynesburg*	45′
2.	*Red shale*	10′
3.	Gray shale	5′
4.	Sandstone	6′
5.	Shales, brown, sandy	10′
6.	*Red shale*	2′
7.	Concealed, with red shale containing limestone nodules near base	24′
8	Sandstone, flagy at top, massive below	20′
9.	Variegated shale with some limestone nodules	28′
10.	Concealed with red shale at base	25′
11.	Concealed	20′
12.	Red shale	15′
13	Sandstone, massive, coarse, *Pittsburg*	70′
14.	Gray, sandy shales containing fossil plants	15′
15.	*Coal*, *Pittsburg*	5′6″
16	Fireclay and shale filled with fossil plants	2′
17.	Concealed to low water in Ohio river	7′
	Total	310′

The *Pittsburg sandstone* is very massive in this vicinity and makes a great cliff along the hills on either side of the river. It is quite coarse and even pebbly in some portions.

The *Pittsburg coal* is well exposed along the water's edge, and, excepting 6 inches of slaty coal at the top, seems to be good coal throughout.

Just below the locality of this section, at Hartford City and other neighboring towns, salt has been manufactured on an extensive scale. The salt well borings begin at the horizon of the *Pittsburg coal*, and salt water is obtained at a depth of 1,125–1,150 feet. Mr. G W Moredock, who operated one of the largest salt manufactories, gave me the following particulars concerning the rocks passed through in the borings:

"For the first 450 feet, a succession of red shales, sandstones, and marly beds with some lime; then comes a coal bed 5′ 6″ to 7′ thick; interval rocks 150 feet; coal bed, pitchy, like asphaltum, 2′; interval 100 feet; coal bed 7′ to 8′ thick; sandstones and shales 375′–400′; *salt rock*, a very pebbly, loose sandstone 40′ to 60′ thick; limestone to bottom of drill holes, 15′. Some oil is found at 400′; the salt water occurs throughout the *salt rock*, but the wells are always drilled through it and 10′ to 15′ into the limestone below, so that the water is pumped up from the bottom of the pebbly rock, as there seems to be much more water at the line of contact between the *salt rock* and the limestone than at any horizon in the former."

From the foregoing statement it would seem most probable that the salt bearing stratum is the basal member of the *Pottsville conglomerate* (No. XII); for the *limestone* reported from the bottom of the wells must be the top of No. XI, or the *Mountain limestone*. How much of this interval of 1,150′ belongs to No. XII cannot he precisely known, though it is most probable that the last 300′, at least, belongs to that series and possibly 400′, since only 100 miles distant, on New River, W. Va. the *Conglomerate series* is 1,200′ thick, or more than the entire interval (1,150′) of the *Barrens*, (*XIV*) *Lower Coal measures* (*XIII*), and *Conglomerate* (*XII*) at Hartford City.

Below this latter town, the Pittsburg coal gets higher above the river, and, as is well known, has long been mined extensively in the vicinity of Pomeroy and for some distance further down the Ohio; but when this strata turns southward, below Pomeroy, the broad terrace deposits on the W. Va. side of the river cover up the horizon of the *Pittsburg* coal, and that, at the same time, seems to thin away to an insignificant bed, only 1′6″– 2′ thick, since below the mouth of Leading creek, 5 miles from Pomeroy, no mines of any importance are found in the river hills, which there recede to a considerable distance from the stream.

In the vicinity of Point Pleasant, at the mouth of the Great Kanawha river, a bed of coal, 2′3″ thick, has been opened at 80′–100′ above low water; this seems to represent the *Pittsburg bed.*

The following Section (30) was taken in descending Point Pleasant hill to Crooked creek, a short distance above the mouth of the latter:

1.	Concealed from top of knob	10′
2.	Sandstone, massive	25′
3	Concealed	100′
4.	Sandstone, massive, upper half gray, coarse, pebbly, lower half blue, rather fine grained quarry rock	60′
5.	Concealed	15′
6.	Shale, marly and purplish, with small limestone nodules	5′
7.	Concealed and flagy sandstone	55′
8.	Fireclay with appearance of *coal*	2′
9.	Concealed to low water in Ohio river	50′

The locality where the 2′3″ coal bed was opened was not seen by us in the vicinity of Point Pleasant, but I was informed that it was directly below the massive sandstone, No. 4 of the section; if this be true, then the latter would represent the *Pittsburg sandstone*, and the coal would belong in the concealed interval No. 5, while No. 8 would represent the small coal bed (probably Little Pittsburg) which Prof. Andrews reports as occuring in Gallia county, Ohio, at 50′–60′ below the *Pittsburg coal.*

The Natural Coke, and Associated igneous and altered Rocks, near Richmond, Va.

By Prof. Wm. B. Rogers.

(Proc. Boston Soc. of Nat. History, 1854–6.)

In the district on the north side of the James river, where the most valuable seam of coke has been explored, it is at present wrought by two vertical shafts. In that nearest the outcrop, the coke is reached at 112 feet from the surface; in the other at 207 feet, the dip of the coal measures being nearly west, and at a low angle. A third shaft, recently wrought, which lies nearer the margin of the basin than either of the preceding, cuts the stratum of coke at the depth of 90 feet. A bed of whin-stone, or coarse, gray trap, is intercalated in the coal measures of this part of the basin, intersecting the two first-mentioned shafts, but croping out a little west of the third. This bed is met with in the deepest and most western of the shafts, at a distance of about 100 feet from the surface, and is more than 30 feet thick where it is cut through; but in the next shaft it is struck at a depth of less than 30 feet, and has thined down to about half the preceding thickness.

One of the most remarkable effects produced by this igneous bed is seen in the stratum of carbonaceous fire-clay which lies next beneath. This, which in the second shaft has a thickness of eleven feet, has been greatly indurated, and made to assume a columnar structure, by which the whole mass is converted into a congeries of closely packed five and six sided prisms, often quite regular, usually about half an inch in diameter, and always at right angles to the lower surface of the trap. A portion of this bed, originally occupied by impure coaly matter, presents the same columnar structure, but the material is a compact plumbaginous coke, with much earthy matter intermixed. The general aspect of the gray part of this bed strongly resembles that of the coarser varieties of fire-brick after they have been long exposed to intense heat. This is what might be expected, for in the bed in question we have the very materials of fire-brick, and in the overlying trap we have a source of igneous action which, in the originally molten condition of this substance, could not fail to work great changes in the contiguous strata. This columnar indurated clay, or natural fire-brick, when recently broken, emits a most offensive odor, partly that of sulphureted hydrogen, and partly, perhaps, caused by a sulphuret of carbon.

At the depth of about seventy feet below the bottom of the trap occurs a bed of natural coke, for the mining of which chiefly these openings have been made. This interval below the fire-clay is occupied by bluish and drab argillaceous sandy slates, with some worn sandstone, the former abounding in impressions of plants, among which may be noted Esquisetum columnare, Zamites obtusifolius, and Tæniopteris magnifolia—forms which, many years ago, Prof. Rogers pointed out as marking the Oolite age of these coal-bearing strata. The baking action of the trap is curiously shown in all these fossils. The coaly matter of the stems and fronds when closely examined is seen to be bleby, or blistered. It is, in fact, coke, which, while it retains the outlines

the south side there is but one workable seam of coal. It is, however, of magnificent thickness, locally rising to 50 and 60 feet, and averaging from 20 to 30 feet. The full thickness of the coal strata on the south side in the lowest places of the basin, is nearly 1,000 feet.

Some costly and extensive mines have been opened in this basin, and the deepest coal shafts reach 700 or 800 feet in perpendicular depth. Most of the mines, however, have been opened on the ridges, to reach the first valuable coal. Whether by reason of the slave system, which retarded social progress, or because of the cost of opening the mines or the inferior quality of the mineral when opened, this coal region has made no progress in comparison with other coal fields of Pennsylvania, Ohio and Illinois.

The Catawba, Botetourt Co., Va., Coals.

W. G. Atkinson M. & C. Eng., under date of October 1, 1865, reported to J. R. Anderson & Co., of the Tredegar Iron-works, Richmond, Va., who then owned the Catawba furnace lands, concerning these coals, as follows:

"The coal mines and the coal series extend over a considerable part of this property, the coal series being opened at various points along a line, extending like the iron ores, for at least 4 to 6 miles of length, and doubtless further, as subsequent researches may reasonably be expected to show.—There are from 5 to 7 separate and distinct beds, 3 of these being workable and of value. They all lie in close proximity to the ore bed and for the most part geologically parallel with it. The thickest seam of coal presents a breast of 5½ to 7½ feet of pure merchantable coal, it is even more than this near the outcrop, measuring upwards of 8 feet, which is perhaps, by this excess, ascribable to a local cause in a slight roll of the roof materials. This main seam is opened at two points both by drift and slope. The latter is driven down into and with the coal for 78 feet, and is designed to extend for 300 feet in all, or farther still if found to be requisite for opening up the large area of working ground which is here so favorably presented. The slope is well timbered and laid with a double track on an inclination of about 35°, coincident with the lay of the coal. This slope can be easily operated with a horse gin, as intended, or still more advantageously with a small stationary engine. Two bands of slate of a soft and friable character occur in this coal, thus dividing the bed into 3 layers, the two uppermost ones being the thickest in forming the breast above described as yielding from 5½ to 7½ feet of coal. The roof of the "Big vein"," as it has been termed, consists of a hard black slate, ranging from 5 to 10 feet in thickness and above this is a strongly defined massive sandstone 7 to 10 feet thick. No better roof materials can be found in any coal mine of Virginia. The floor consists of a soft grayish slate and sandstone passing into a fireclay. It admits of easy lifting so as to perfect the grades, etc., throughout these grounds.

At an approximate depth of 25 feet below the "Big vein" occurs the Two-band coal. This measures some 22 to 24 inches of coal in the two layers which compose it, separated by a small band of soft slate averaging 12 or 14 inches of thickness. In the several openings which have been made into this seam,and worked at divers points a mile or so apart, the roof consists of a soft grayish slate; 3 to 4 feet thick, on which rests a massive sandstone. The latter is regarded practically as the roof proper under which to work this seam.

Below the two several veins already described, the "main seam" and the "Two-band coal," occurs a vein of some 2½ to 3½ feet thick, the drifts of which have not been worked for a long time, and the debris falling in about the pit's mouth prevents a view of this coal bed. This seam, which may be designated as No. 3, has been opened at a point directly west of and about 200 yards from the main shaft in the ore mine, and also about 1⅛ miles only from the furnace. It may be possible that No. 3 and No. 1—the "main seam" are identical—but all the circumstances attending the position of both veins do not readily support this supposition.

Quality and Uses of the Catawba coals.—The products from the coal mines of the Catawba Coal and Iron Co's lands have been in use for over 77 years—which would represent the fact that they are among the oldest collieries in America—one of the ancient grants from the Commonwealth of Virginia under Gov. Patrick Henry—for a part of this estate—refering to a certain "cole pitt"—which is one of those now being described. The Catawba coal belongs to what may be designated as the semi-bituminous class, though it has been termed semi-anthracite. It rightly would be considered by experts in the art of mining and in the manufacture of metals as belonging to the varieties midway between the semi-anthracites and semi-bituminous. Some portions of these several coal veins of the Catawba estate are larger and heavier than others, and carry well to market without without disintegrating, as do the coals of the Alleghanies.

They all burn well in any and every way they have been applied. The uses for which they have been heretofore taken are namely for foundries, for smiths' fires and for domestic fuel. It is highly probable that the harder and more refractory bands will be adapted well to the manufacture and refinement of metals. It has been believed that a hot-blast attachment to the furnace can be introduced so as to utilize the heaviest, hardest and driest coals of the Catawba region in manufacturing pig metal. These coals have for a long series of years been in constant demand for the above several uses and transported by wagons over a wide extent of country—being carried in some cases for 30 to 40 miles and even to 50 miles—the latter place of consumption being a foundry on Irish creek, in Rockbridge county."

Catawba Furnace, Va., in 1865.—In a manuscript report that has come into our possession we find the following description of Catawba Furnace, Botetourt county, Va., made in Oct., 1865, by W. G. Atkinson, C. & M. E.:

Agreeable to instructions I have made a Geological survey of the Catawba Coal and Iron Co's Lands, situated in Botetourt and Roanoke counties, Virginia, and beg to report to you the result. The property, comprising, by original grants from the Commonwealth of Virginia, some 7,200 acres, is located upon the eastern slopes and along the base of Caldwell mountain. The distances from the Coal mines, the Ore banks and the Iron furnace —a common centre to all of which may be considered as, approximately, also the centre of the estate—are as follows, to certain points of outlet to market, viz:

Fincastle 9 miles, Salem 18 miles, Bonsack's Depot 15 miles, and Buchanan 20 miles.

The furnace is substantially built, operates with charcoal fuel, is run by the water power of Catawba creek and is in a good state of repair. It will be ready to go into blast again so soon as the hearths are set, for which materials are on the ground. The height of stack is 41 feet, and size of bosh 9½ feet. Capacity 35 to 40 tons per week—20 an average, though 50 tons of superior metal have been made per week. The quality of metal is similar to the best Scotch pig, but much stronger. It is extremely fluid and is well adapted therefore to fine castings. It has been used to eminent advantage in the manufacture of machinery, hollow ware,stove plates, agricultural implements,chilled wheels,light ordnance, &c., &c.; 5,000 cords of wood for coaling are cut and ranked, ready for seting in the kilns Flux is abundant,

of a superior quality of limestone, and the quarries are immediately at the furnace. Ores of iron, the red and brown oxides, are extensively developed on a line of 4 to 6 miles in length, stretching through and along the centre of the estate. The main shaft in part of this ore bed is 1¼ miles only from the furnace, all down hill haul by a good road.—The seam of ore at this point is 10 to 12 feet thick, and it even enlarges to 14 and 16 feet. It is easily worked and affords a large yield of metal.

Improvements at the Coal mines and the Furnace.—Near the openings and workings into the coal, the improvements consist of two new cabins, roofed and floored, complete for miners, 2 shops for blacksmith and wheelwright purposes, 1 new stable, one platform for coal and gin house attached with fixtures for hoisting the coal out of main slope. The grounds near the principal collieries are well adapted for laying out and building a mining village. Roads of easy grades are opened throughout the estate, and the contour of the country is every way favorable for the introduction of tram-roads as a cheap and speedy mode of exit to and connection with the main avenues to market. These are respectively the Va. & Tenn. RR., at Bonsack depot, and the James River and Kanawha Canal, at Buchanan, which latter avenue to cities and towns in East Virginia, is seldom interrupted by the rigors of winter.

At the furnace the buildings consist of 1 large new coal house, a coal shed, 1 large stable with granery attached, 1 blacksmith and wheelwright shop, 1 corn choping mill, making 100 bushels of meal per day, and 1 saw mill, making 12,000 feet of lumber per day—both driven by water force never failing, which is also the power that drives the furnace; there is also here 1 managers house, 1 new frame boarding house, 6 cabins for workmen, office, feed-house, 1 shed, ore-washing machine, &c. &c., all complete to operate the iron-works extensively.

The Catawba Coal and Iron Co's property is well clad in the several varieties of oaks, pine, hickory, walnut, locust, lin, maple, beech, &c. The future uses of lumber for buildings, &c. can be readily supplied from different sections of the estate, and no better lumber can be found in the state, whether for weatherboarding, framing, shingling, lathing or otherwise. The water-power on this property along its borders is of an interesting character in view of what may be contemplated in establishing different branches of manufacture, such as taning, tub, bucket and barrel making, and for the purposes of oil, paper, cotton or woolen mills.

For lime-burning, the Catawba property is well supplied with such quantities of rock as produce a good lime, either for domestic or mechanical purposes. There is a great and growing demand for lumber and lime, owing to the recent decay and positive destruction of the improvements of a large area of country—as the events of war.

There are from 100 to 150 acres of cleared land and on a part of this a crop of corn is now standing which it is estimated will yield 3,000 bushels.

Quality of Soil, &c.—The lands of the Catawba Coal and Iron Co., when deadened of their timber or cleared up and put in crops, are well adapted to all the cereals, grass, clover, vines, fruits and garden vegetables. Vineyards in the vicinity have flourished and produced finely of the Catawba and Isabella grapes, and the native varieties along the mountain side are abundant bearers each successive fall. From a greater portion of this estate being so situated as to look south and east, it is confidently believed the culture of the grape could be here attended with peculiar advantage.

Other Various Resources of the Property.—On these lands and interspersed among the mineral beds are strata of millstones, grindstones, hearthstones, and inwall-stones, all of which, from this or like localities, have been wagoned to remote distances for a long number of years. Among the coal measures also fire-clays are found which offer favorable indications for utility in manufacturing fire-brick, stove linings, water-pipes, tiles, &c.

All the beds of coal, iron ore, fire-clay, &c., incline conformally to each other at an angle of 30° to 50° from the Catawba mountain, along the lower slopes of which they range, and in every case they are easily accessible, cheaply worked, and to a great extent susceptible of being wrought so as to be "level free" or above water.

The Catawba Coal & Iron Co's property, whether regarded as the basis of single or combined iron enterprises and the place for extensive colleries, tanyards, timber mills, lime burning, the opening of quarries, the manufacture of fire-bricks and other refractory materials, is certianly and obviously one of the most inviting and available mineral properties in the South. It evidently is well located for health of operatives, ready supply of provisions, for cultivation of desirable crops and for introducing into the country an industrious, steady and thrifty class of laborers and artizans in various branches.

The early prosecution of the railway extension from Winchester to Salem along the Valley of Virginia, will pass near the property, and this alone as one of the required improvements eminently demanded now by the state, and already eliciting general and urgent attention, is likely to enhance to a manifold degree the available worth of this large estate, whose real and intrinsic resources are so striking.

The public school fund of Virginia has had contributed to it by taxation, interest on literary fund, and fines, in the 10 years from 1871 to 1880, inclusive, the sum of $4,173,505, distributed through the years, as follows:

1871	$362,000.00	1876	$474,596.22
1872	432,109.78	1877	357,742.68
1873	460,024.00	1878	243,144.00
1874	432,013.82	1879	286,264.00
1875	488,490.44	1880	637,120.17

This money was distributed, for free public schools, to the counties of the state in proportion to the school population in each, and was spent in the maintenance of free schools for all classes of the school population of the state.

Spanish chestnuts have been successfully raised in Maryland by grafting on our common chestnut, thus furnishing an earlier and much larger nut. Mr. Geo. Balderston, of Colora, Md., is the benefactor who has introduced this improved nut.—Let us have it in the Virginias, where the chestnut trade, especially from the early crop of the Blue Ridge, is already a large one. The old "coalings" all along the Blue Ridge are now covered by the finest of young and vigorous chestnut groves, the trees of which are now in the right condition for grafting, as any one can see that will look from the passing trains, say of the Shenandoah Valley RR., at Vesuvius station. The Spanish chestnuts sell for three or four times as much as our native ones.

Fire-clay is dug at New Cumberland, on the Ohio river, W. Va., from a bed, 6′ to 8′ thick, that is overlaid by a bed of coal from 2′ 6″ to 3′ thick which is used to burn the fire brick made there. The clay in place is very hard; it is mined by drilling and blasting, but on exposure to the weather it crumbles and becomes soft.

Flat-top coal and coke.—Supt. W. A. Lathrop, of the S. W. Va. Improvement, Co., Pocahontas, Va., on Norfolk & Western RR., sends the following statement of the output of coal and coke by that company during September, 1883:

Coal coked during September, 2,000 lbs. tons	6,289
Coal shiped " " " " "	8,733
Total output of mines in September	15,022
Coke made in September, tons	3,773

This shows a yield of 60 per cent of coke from the coal put into the ovens during the month.

On page 138 of Sept. No. we reported the output of these mines and ovens to Sept. 1. 1883, as 34,872 tons of coal shiped and 10,140 coked; making a total output of 45,012 tons.—Adding the above, the output to Oct 1, 1883, has been 60,034 tons of coal and 9,857 tons of coke.

Below are the accurate measurements of the strata that make the "*Big*" *or No. 3 bed of coal* at Pocahontas, the one mined by the S. W. Va. I. Co., kindly sent us by Supt. Lathrop:

1. Sandstone roof, massive	....
2. Fire clay	1′ 0″
3. Bony coal	0′ 8″
4. Good semi-bituminous coal	4′ 8″
5. Slate parting	0′ ½″
6. Good semi-bituminous coal	5′ 6″
7. Slate	0′ 3″
8. Good semi-bituminous coal	1′ 0″
9. Fire clay floor	....
Total thickness of "big bed"	13′ 1½″

During this month we have visited the coal mines, the coke ovens, and the village of Pocahontas, and found everything moving along in a very gratifying way. The Southwest Va. Improvement Co. has done, and is doing, a large amount of excelent work, so that its mines, ovens, and village are all in excelent condition and constant progress is being made in making them all still better. They are clearing up the new streets, building a large store and office building, a large and well-planed school-house, etc. The main drift at the mines has now penetrated the "big bed" of coal a distance of over 2,000 ft. Thirty-two cars of coal were shiped on the day of our visit; we noticed that they were labeled for Hollins Institute, Norfolk, Burkeville, Lynchburg, Roanoke, Lexington, etc.

The Quinnimont Coal & Iron Company, that was recently organized by the purchase of the blast-furnace property and coal lands at Quinnimont, Fayette county, W. Va., on the line of the Cheasapeake & Ohio Ry., took possession of the purchase on the first of this month. Mr. George M. Bartholomew, of Hartford, Conn., having ended his receivership with September. Mr. F. A Comly, of 407 Walnut st., Philadelphia, is president, and Mr. Charles Gilpin is secretary of the new company. Mr. James F. Lewis, who has so successfully managed operations at Quinnimont ever since this fine property passed into the hands of a receiver, will continue his management,—in fact the furnace has continued in blast, producing an iron of uniform and excelent character. We have it from the best authority that during all of the protracted receivership just ended the manufacture of pig iron at Quinnimont has been a paying business, demonstrating—(as before during the "panic years," under J. H. Bramwell's management)—that, under all experienced conditions of the markets, iron can be profitably made, under good management, in the central coal and iron region of the Virginias.

Condition of Virginia blast-furnaces, Oct. 1., 1883.

From the report of the Iron Age, of New York, on the condition of the blast-furnaces of the United States, Oct. 1, 1883, we gather the following statement of the condition of the blast-furnaces of Virginia at that date:

1. Charcoal furnaces in Virginia.

Total number of stacks	31
Number reported in blast	10
Capacity per week, in tons	480
Number reported out of blast	21
Capacity per week, in tons	982

2. Coke or bituminous coal furnaces in Virginia.

Total number of stacks	13
Number reported in blast	8
Capacity per week, in tons	3,670
Number reported out of blast	5
Capacity per week, in tons	1,210

It appears from this report that the charcoal furnaces of Virginia in blast Oct. 1 were making about 1-26th of the charcoal pig made in the U. S. at that date, and that its coke furnaces were making about 1-14th of the coke and bituminous pig made in the U. S.—It should be added that every furnace in Virginia that was constructed to use coke or bituminous coal was in blast Oct. 1, and is in blast now.

Uniform standard time.—Most of the railways of the U. S. have agreed to adopt, on the 18th of Nov. next, a new standard of time, as follows:

The whole territory of the U. S. will be divided into four north-and-south belts, each 15° wide. Through the middle of the first belt on the east runs the 75th meridian, or the line of 75° west from Greenwich; this will be called *Eastern time*, by it will be run all the railways between the Ohio river and the eastern point of Maine; it will be very nearly the present local time of Philadelphia, as the 75th meridian is near that city; it will be the standard time for all of Virginia and West Virginia, making it necessary for us to "set forward" our time pieces a few minutes, since these states lie between about 75° 30′ and 83° 30′ of west longitude, a difference of 8° of motion, or earth surface, and 32 minutes of time.—The watches of our Chincoteague oyster catchers will not have to be set forward more than 2⅔ minutes, but those of our iron ore digers at Cumberland Gap must be moved forward 32 minutes; and in proportion between these points, allowing 4 minutes for each degree.

Through the middle of the second belt passes the 90th meridian, 90° west longitude, and all places in that belt, that is between 82° 30′ and 97° 30′ west, will use the time of the 90th meridian, which is to be called *Central time*; it will be one hour later than Eastern time. The 90th meridian is nearly that of Springfield, Ohio, and New Orleans, La.; this belt extends from about Sandusky to beyond Omaha.

The third belt has 105° west, that of Denver, for its meridian; its time will be called *Mountain time*; the fourth belt will have the 120th meridian, that of Carson, Colorado, and its time will be called *Pacific time*. Each of these time belts will be one hour later than the belt east of it.

As the National Observatory, the Signal service, and other authorities, as well as the railways, have agreed to adopt this scheme of standard time, it will probably be at once adopted in all parts of the country, greatly to the advantage of most of the people.

The Vote of Virginia at the Nov. 1882, election for congressman-at-large, as counted by the state returning board, was 198,518; the voting population of this state, males 21 and over, at the census of 1880, was 334,505; so only about five-eights of the voters voted at that election.

Eastern Shore, Va.—The wonderful growth and development of the agriculture of the Eastern Shore has, we might almost say, made every man upon its soil independent. The culture of the potato, especially the sweet potato, exceeds anything one can imagine. They come early and are hurried off by the steamers to all the great cities on the Atlantic coast. Sometimes the earliest shipments bring from eight to ten dollars per barrel. Of course other products are raised, for the land is rich and kind and will hand back anything you put into it.—*Religious Herald*, Richmond, Va.

Railway Weather Service.—The chief of the weather bureau of the signal service, Gen. Hazen, is desirous of announcing predictions of weather changes by the display of signals on moving railways trains, as is now done by some of the Western states. This would be an advance of the good work this service is now doing, one that would be very valuable to the entire community, but especially so to the agriculturists. Congress has not dealt as liberally with this service as it should have done. There are many ways in which it could be made more efficient if it had the means, and its friends—and if they all knew about what it has already done everybody would be embraced in that list—must see to it that during the next session of Congress better provision is made for this service. With its customary liberality in things that promote the general welfare, the Baltimore & Ohio Railroad has notified the weather bureau that it will provide, at its own charge, for the display of signals on its trains. How much human and animal comfort could be provided for if the early morning train signaled all along the course of its westward day's journey, at the rate of 30 miles an hour, that a biting "northeaster" was coming a few hours behind it!

Cincinnati Iron Market.—Under date of Oct. 23, 1883, Messrs. E. L. Harper & Co. report to *The Virginias*, as follows:

The business of the past month has been fairly up to the usual traffic for the period, and while prices have gradually receded through the month, the figures we quote below represent the current prices for the past week, which seem to be on the "grade floor," and indicate there is no reason to expect any further depreciation.

Foundry.

Virginia strong neutral coke, No. 1, at $20.00 to $21.00, 4 mos.
" " " " No. 2, at $18.50 to $19.50, "

Gray Forge.

Virginia strong neutral coke, at $17.25 to $18.00, 4 mos.

Car Wheel.

Southern car-wheel, strictly cold blast, $27.50 to $28.50.

The Virginia State Fair that will be held at Richmond Oct. 31 and Nov. 1 and 2, promises to be a very successful one. The railways offer tickets to Richmond during this fair at half rates.

Coal to San Francisco.—The Baltimore Journal of Commerce, of Oct. 27, states that a new Maine ship of 2,341 tons, has been chartered to take coal from Baltimore to San Francisco for about $6 per ton.

The game laws of W. Va. prescribe the dates for the legal killing of wild game, as follows:

Deer, between Sept. 1st and Jan. 15th; quail or Virginia partridge, between Oct. 15th and Jan. 1st; wild turkey, ruffled grouse, pheasant, pinnated grouse or prairie chicken, between Sept. 1st and Feb. 1st; blue-winged teal, mallard or wood duck, or any other wild duck, wild goose or brant, between Nov. 1st and April 1st.

The Natural Coke of Va.,—Reply to Dr. Raymond.—In our last issue, page 145, was published a paper which Dr. Raymond read before the Am. Inst. of M. Engs., on the Natural Coke of Chesterfield county, Va., in which he called in question the conclusions of the late Prof. W. B. Rogers and of the writer as to the mode of the formation of this coke or carbonite; that is that it "was due to the coking of the original seam of coal by the intrusion of a trap dike;" arguing that such a view "would be more plausible if the presence of a trap-dike large enough to produce this effect, and so situated as to produce it upon a single bed alone, and not upon overlying and underlying beds could be clearly shown." Dr. R. concludes by stating "that among the samples sent to me from the locality, there was no eruptive rock."

The section published with Dr. Raymond's paper begins with "Whin rock 2' 6' thick," and ends with "Thin layers of whin rock, occasionally." Is there "no eruptive rock" in this section? Lyell (Elements of Geology) in his explanation of the names, mineral composition, etc., "of the more abundant volcanic rocks," informs us that "Whinstone is a Scotch provincial term for greenstone and other hard trap rocks." So there must have been "eruptive rocks" in the section and near the carbonite, whether any of them were sent to Dr. R. or not.

In this issue, page 158, we present the views of Prof. W. B. Rogers, the result of of his own observations (and no one ever observed and then reasoned from his observations with more pains-taking and conscientious care) on this question.

We submit that his arguments are conclusive that the carbonite of the Richmond coal-field is the result of the action of eruptive rocks on beds of coal. His statements are based on the carbonite beds north of the James, but he mentions those south of that river in a way that shows his equal familiarity with them and the conditions of their existence.

Manganese.—Mr. A. W. Morris, C. E., formerly of Shenondoah Valley RR., now has charge of mining operations at Crimora, where the usual good results of mining operations, in the splendid deposit of manganese there found, still continue.—A Mr Banks has been prospecting for manganese on the Patrick land, in Augusta county, Va., near the Crimora mines.—It is reported that good manganese ore has been discovered near Lyndhurst station of S. V. RR., Augusta county.

The Wyoming Manufacturing Co. mines coal at Handley, on Ches. & Ohio Ry., Kanawha Co., W. Va.; its officers are John Handley, president, G. D. Dimmick, vice-president, J. H. Campbell, treasurer, Laton S. Oakford, secretary, and J. C. Evans, superintendent.

Complimentary.—We are indebted to the Daily Review, the newsy and very readable daily recently started at Roanoke, Va., for the following:

"The October number of *The Virginias*, the well-known scientific monthly, which is so ably edited by Maj. Jed. Hotchkiss, of Staunton, is full of valuable information and data. It is a paper for every one who has direct or indirect interests in the development of Virginia; for study, for fine maps and mining news it is unequaled. It is more than worth the low subscription of two dollars a year, and the man who is seeking investments in this state must have it for reference."

Victoria Furnace of the Iron & Steel Works Association of Va., near Goshen, Va., on Ches. & Ohio Ry., made 3,100 tons of pig iron in Oct.; the largest days work was 130 tons; its output this year, to Nov. 1, has been about 16,000 tons. It obtained 49.9 per cent of iron yield from the ores of its mines, in the furnace, during Sept. It is now using, exclusively, coke from the Hawks-Nest ovens, on the C. & O. Ry., with the best of results; in fact they are disposed to believe it the best coke they have used so far.

The Virginias.

Serial No. 47. Vol. IV.—No. 11.

Staunton, Va., November, 1883.

Jed. Hotchkiss, - Editor and Proprietor.

Table of Contents.

Errata.—In Mr. Brainard's article, on page 173, in 29th line, for "played" read placed; in 42nd line "over" should be at; "one" in the 49th line should be ore; and in the 3rd line of 2nd column, "Roggue" should be bogger's.

The Rockbridge tin ore prospects appear to be very good. A letter of the 20th from Mr. Edgar Whitehead, of Amherst C. H., Va., one of the owners of the newly discovered leads of ore, informs us that "the Cash mine has now 6 or 7 cuts that show good ore in a continuous vein" and the writer "has no longer any doubt as to the quantity or continuity of a well defined vein runing with the strata of the country."

Danville & New River RR.—On the 3rd of Nov. an extension of 13 miles of this road, from Martinsville to Spencer, was opened for business. It will soon be completed to Patrick C. H., when it will have compassed about half the distance from Danville to some point on the Norfolk & Western near New River station.—The most excelent paper by Prof. Fontaine, the first of which appears in this number, shows the mineral resources of the region tributary to this road.

Crozer furnace, with an ore yielding 46 per cent of iron, smelted 5,600 pounds of ore with 3,000 pounds of Connellsville coke.

Condition of Virginia blast-furnaces Nov. 1.—In the Bulletin of the American Iron & Steel Association of Nov. 14, 1883, there is an enterprising and timely article on the condition of blast-furnaces in the U. S. and of Stocks of pig-iron on hand Nov. 1, 1883. From that we gather the following items:

1. Condition of all furnaces.

	Va.	W. Va.	U. S.
In blast Jan. 1st, 1883	15	5	417
" July 1st, "	16	3	334
" Nov. 1st, "	15	5	331
Out of blast, Nov. 1st, 1883	27	7	355
Total, Nov. 1st, 1883	42	12	686

2. Charcoal furnaces.

	Va.	W. Va.	U. S.
In blast Jan. 1st, 1883	12	..	129
" July 1st. "	8	..	98
" Nov. 1st, "	7	..	98
Out of blast Nov. 1st, 1883	23	5	144
Total Nov. 1st, 1883	30	5	242

3. *Coke and bituminous coal.*

	Va.	W. Va.	U. S.
In blast Jan. 1st, 1883	3	5	127
" July 1st, "	8	3	111
" Nov. 1st, "	8	5	116
Out of blast Nov. 1st, 1883	4	2	107
Total Nov. 1st, 1883	12	7	223

In the U. S. there were in blast, Jan. 1st, 417 furnaces, July 1st, 334, and Nov. 1st, 331; out of blast Nov. 1st, 355; total furnaces Nov. 1st, 686.

The stocks of pig-iron on hand and unsold, in the U. S., July and Nov. 1st, 1883, in 2240 lbs. tons, are stated as follows:

	July 1st.	Nov. 1st.
Bituminous	196,099	128,830
Anthracite	186,735	158,521
Charcoal	145,756	145,003
Total	528,590	432,354

The stocks in W. Va. are given as 5,194 tons July 1, and 3,138 Nov. 1. Virginia is not honored with a separate statement, but is grouped, for no reason that we know of, with N. C., Ga., and Texas; *a clear case of bad treatment* when Texas is credited with *one* furnace in blast during the year, North Carolina with *none*, and Georgia with 4 of her 6 furnaces out of blast Nov. 1st., while Virginia is now daily producing not far from 600 tons of pig iron.

Elsewhere we comment on an error of statement in this report. The Bulletin remarks:—On the 1st of Nov. there were no stocks worth mentioning in the hands of speculators, nor were there at any of our ports any noteworthy stocks of foreign pig iron,—Taken altogether, our statistics of furnaces in blast and stocks unsold on Nov. 1st are favorable to the pig iron makers, especially when it is considered that stocks in the hands of consumers are notoriously low, owing to the prevalence for several months of the hand-to-mouth policy.

Railway time tables of all the railways in the Virginias, now that Eastern Standard time has been adopted, will appear in the next number of *The Virginias;* we could not get the necessary information for this issue.

Coke pig-iron furnaces in Va.—A valued correspondent asks for information concerning the blast furnaces of Virginia now making pig-iron with coke as a fuel; he will find an answer in these items, which will also be of interest to others.

1. *Lucy Selina.*—Two stacks of Longdale Iron Co.; daily capacity, 75 to 80 tons; located at Longdale, on Simpson creek of Cow-pasture river, Alleghany county, Va.; connected with Longdale station of Chesapeake & Ohio Ry, by 8 miles of narrow-guage railway.—Gets coke from its own ovens and mines at Sewell, W. Va.

2. *Low Moor.*—One stack of Low Moor Iron Co. of Va.; daily capacity, 100 to 120 tons; located at Low Moor station of Chesapeake & Ohio Ry., Alleghany county, Va.—Makes its own coke in ovens at the furnace from coal from New River, W. Va. mines.

3. *Callie.*—One stack of Hileman, Waring & Co.; daily capacity, 20 to 30 tons; located on Rich-patch mountain, Botetourt county, Va., connected with Chesapeake & Ohio Ry., west of Clifton Forge station, by standard-guage branch railway, about 5 miles long.—Uses New River, W. Va. coke.

4. *Victoria.* One stack of Iron & Steel Works Association of Virginia (limited); capacity 120 to 150 tons; located 1 mile from Goshen station of Chesapeake & Ohio Ry., Rockbridge county, Va., with which it is connected by both standard- and narrow-guage railways.—Uses coke made from Kanawha Middle measures coal, in Soldenhoff-Coppee coke ovens, at Hawks Nest, on C. & O. Ry., W. Va.

5. *Gem.*—One stack of Shenandoah Iron, Lumber, Mining and Manufacturing Co.; daily capacity, 60 to 70 tons; located a short distance from Milnes station of Shenandoah Valley RR., Page county, Va., with which it is connected by standard-guage railway.—Is now using Connellsville coke, because the ovens at Pocahontas cannot supply Flat-top coke at present.

6. *Crozer.*—One stack of Crozer Steel & Iron Co.; daily capacity 100 to 120 tons; located at Roanoke, Roanoke county, Va., at junction of Shenandoah Valley and Norfolk & Western railways.—Uses Flat-top coke from Pocahontas, Virginia.

7. *Lynchburg.*—One stack of Lynchburg Iron Co.: daily capacity, 30 to 35 tons; located at Lynchburg, Campbell county, Va.—Near junction of three lines of railway.

These eight are the only blast furnaces in Virginia that have, for a number of years, made coke pig iron.—There are two stacks of moderate capacity, at Buffalo Gap station of Chesapeake & Ohio Ry., Augusta couuty, Va., that, when in blast, a number of years ago, made coke pig iron. They are known as *Buffalo Gap* furnace and belong to the N. Y. & Va. Iron & Coal Co.—There is also a stack at Ferrol station, of Chesapeake & Ohio Ry., Augusta county, Va., known as *Grace* furnace, that when in blast, several years ago, made coke pig iron. It is now in litigation.

The only new coke iron blast furnace that is now in course of construction in Virginia is one at Wilton station of Richmond & Alleghany RR., Botetourt county, Va., by Capt. D. S. Cook, near his fine Wilton iron mines Several others will probably be erected the coming year, as arrangements are being made for them.

Mr. James M. Swank, in his report on the Condition of blast furnaces in the U. S Nov. 1, 1883, in The Bulletin of the Am. Iron & Steel Association, does not correctly report these furnaces, as above, but states that 8 were in blast and 4 out, when it should have been 8 in blast and 3 out, as stated above. Every coke furnace in the state that has gone into blast in the last three years is now in blast.

The Bridge over the Ohio, at Point Pleasant, W. Va., for the Ohio Central RR., will soon be completed and Charleston, the soon-to-be permanent capital of West Virginia, will have an unbroken railway connection with the country west of the Ohio river.—In recent issues of the "American Engineer," of Chicago, plates and descriptions have been given showing the details of this important bridge. From that journal we learn that this bridge consists of a channel span of 420′ between pier centres, of an Ohio shore span of 200′, and three West Virginia shore spans, two of 250′ each and one of 248′ 4″, all measured between centres of piers. There are also 291′ of iron trestle-work on the Ohio side of the river and 1,516′ on the West Virginia side. The entire length of the bridge and its approaches, constructed of steel and iron, is 3,805′, or near four-fifths of a mile. It is made for a single track. Its superstructure was constructed by the Keystone Bridge Co. of Pittsburg, Pa.; Mr. S. M. Seymour is the engineer in charge for the railway.

Elk-garden coal—The W. Va., Press Association recently paid a visit to the Elk-garden coal mines on the W. Va. Central & Pittsburg RR, Mineral county, W. Va.;—from an account of this visit in the St. Albans Nonpareil we gather the following items concerning the mines, furnished by Supt. James Little.

The bed of coal mined at Elk garden is from 12 to 16 feet thick of superior bituminous coal. The output now is about 1200 tons a day. The miners receive from 40 to 60 cents a ton for mining the coal and they mine from 5 to 6 tons each a day. The shipment from Jan. 1 to Oct. 25, this year, were 162,870 tons; the shiping cost is 70 cents per ton. The coal is marketed from Baltimore on the east to Omaha on the west. The Elk-garden mine is reached by a short railway from the main line and by an incline of 1400 feet; the mine cars convey two tons.

The Graichen Glove factory.—The Winchester, Va., Times, is publishiug an interesting series of articles concerning the industries of that grand old historic town, the rightful queen of the famous valley of the Shenandoah. We rejoice in her prosperity.—From these we learn that the Graichen Glove Factory, established there in 1852, by F. A. Graichen, a German, prior to 1861 gave employment to from 50 to 100 persons; now it employs from 350 to 400 and distributes about $60,000 a year for labor alone. It makes 225 different styles of gloves and mittens which range in price from $4.50 to $60 a dozen. Its goods find a ready market, because of their superior quality, in every portion of the United States.

Prof. Fred. P. Dewey has returned, with improved health, to his post as Curator of Metalurgy at the National Museum, Washington, D. C., and resumed his researches on the Porosity, etc., of American cokes.—The valuable results that Prof. D. has already made public warrant the conclusion that great good will result to our coke and iron makers from the series of new and carefully conducted experiments he is now making.

Mr. Alfred F. Brainard, the mining engineer and superintendent of mines of the Low Moor Iron Co. of Va., closes his engagements with that company on the first of next month. By advertisement in this issue Mr. B. offers himself for engagement again. We learn that he has given satisfaction at Low Moor.

Callie furnace, of Hileman, Waring & Co., near Clifton Forge station of Ches. & Ohio Ry., that has been out of blast for a short time, went into blast again Nov. 1, and is now having a satisfactory run.

Notes on the Geology and Mineral Resources of the Floyd, Va., Plateau.

By Prof. Wm. M. Fontaine.

The following notes are extracts from a report made by the writer to the Board of Visitors of the University of Virginia. This report gave the results of examinations made in the Floyd Plateau of Virginia, during the months of May and June, 1882. The Floyd Plateau is the belt of high land formed of the counties of Floyd, Carroll, and Grayson. Some examinations were made in the counties of Franklin and Montgomery, and they did not extend, at this period, into Grayson. The counties of Floyd and Carroll, with the southern portion of Montgomery county, which lies within the plateau belt, occupied most of my time. On my way to Franklin C. H., which is known as Rocky Mount, I passed over the Midland RR. and the narrow gauge railroad that leaves the Midland RR. south of Lynchburg at Franklin Junction and extends to Rocky Mount.

Rocky Mount was my starting point for the Floyd Plateau. While on my way to this place I had an opportunity to learn something of the mineral deposits along the line of the narrow gauge railroad, and to notice the geology of the country. Some of the facts thus learnt, I will give before taking up the description of the region about Rocky Mount, and the plateau district.

The strata, from Franklin Junction to Rocky Mount have the same general geological character, and are of the same nature with those shown just south of Lynchburg. They have mainly the lithological character considered by many geologists to belong to the Huronian formation. With the beds of Huronian type occur tender fine grained mica schists, that often contain imperfectly crystalized hornblende. These have more of the nature assigned by some to the Montalban group; I could not, however, find that these micaceous strata are separated from the others by any features except the lithological character of the beds. They graduate so constantly into those that possess the Huronian type, and are so intimately connected with them, that I think they must all belong to the same geological age. At least this seems to be true of the micaceous strata of Franklin and the western portions of Pittsylvania counties. These rocks form the main portion of the Floyd Plateau, and will be noticed again.

Pittsville Iron Ore.

Near Pittsville station, on the narrow gauge railroad, a deposit of good magnetic iron ore occurs. This ore is used for the manufacture of Bessemer steel, and its quality is so good that it justifies transportation by railroad as far as Pennsylvania. As to the amount and geological occurence of this ore, I can say nothing from personal inspection. I infer that the mode of occurence is similar to that of the magnetite at Rocky Mount. It is stated that it forms a layer several feet thick, that dips with the country rock. The stratum is said to have been followed in depth over 100 feet and to be enclosed in clay all the way. If this be true, it shows that the decomposition of the wall rock has penetrated to an unusual depth, and this may, in part, account for the excelence of the ore, as thus, all oxidizable substances have been removed from it. This ore occurs in Pittsylvania county, about 41 miles south of Lynchburg, and 8 miles from Franklin Junction.

Baryta in Pittsylvania county

In the vicinity of the crossing of the Franklin narrow gauge railroad over Pigg river, in Pittsylvania county, a deposite of Baryta occurs that appears to be of some importance, at least if we may judge from the size aud nature of the masses shiped. The lumps that I saw near the river, awaiting transportation, were of large size, and indicated a material of good quality. This baryta is said to occur in clay. I did not visit the locality, and hence cannot give the mode of occurence. This deposit is however, no doubt, the continuation to the southwest of the deposits of baryta in Campbell county. These latter, I had an opportunity some time ago to examine. The baryta of Campbell county occurs in clay, and is found on Otter river, not far from the Midland RR. The clay results from the decomposition of the hydromica schists that enclosed the baryta, and it was formed in place. The baryta does not form a connected and continuous deposit, but is found in lumps and lenticular masses that stand in the clay as they stood in the rock originally. It thus dips and strikes with the country rock. There is no reason to think that the mineral is confined to the clay. The indications are that it descends with the country rock to unknown depths. I have no doubt that the baryta of Pittsylvania is found occuring in the same manner.

Gold in Franklin County.

The rocks between Pigg river and Rocky Mount are of the Huronian type, being composed of hydromica schists, fine grained, rather tender mica schists, chlorite schists, &c. The dip is almost always high and to the southeast. Numerous masses and veins of quartz occur, and some of the veins seem to be of a character favorable for the occurence of gold. I was not surprised to hear that alluvial gold had been found at several points between Pigg river and Rocky Mount. The gold veins, or original deposits,do not appear to have been found. So far as I could learn, the gold found did not occur in quantities that would pay for working in the way search was carried on for it.

Mineral Deposits near Rocky Mount.

Near Rocky Mount we find some change in the lithological character of the rocks. Many of the slates and schists have a good deal of finely granular and poorly crystalized hornblende diffused through them, while the most of the material is of the same nature with the hydromica and other schists of the Huronian type. Some of the strata are largely composed of this hornblende, and they seem to have particles of magnetic iron ore diffused through them in many cases. When weathered they show a good deal of diffused iron in the form of limonite, which causes the strata to resemble a lean iron ore. The workable deposit of magnetite at Rocky Mount appears to be associated with the more richly hornblendic strata. To the west of the village, and just beyond the ore deposit, occurs a wide band of typical and highly micaceous mica schist. This has much the lithological character assigned by some to the Montalban group of Azoic rocks. Its mode of occurence, however, here, indicates that it is simply a band of strata that differs lithologically from the general type considered as making the Huronian formation, but which does not show any stratigraphical features thet would enable one to separate it as a distinct group.

The dip of the strata here is also to the southeast. The average dip is about 50°. The strike is about 60° east of north.

Magnetic Iron Ore of Rocky Mount.

The strata that contain this ore may be classed as micaceous and hornblendic schists and flags. There are two bands of ore. The principal band follows the crest of a low ridge, about ½ mile west of the village. The other band is seemingly an offshoot of the first. It lies about 200 yards still farther west, but gradually approaches the main band. The principal band of ore is the one that supplied the fur-

(Continued on page 178.)

Alleghany Iron M. & M. Co.—We learn that the standard gauge railway of the Alleghany Iron M. & M. Co. from the Chesapeake & Ohio Ry., at its first crossing of Jackson river below Covington, up Pounding Mill run five miles to the great iron ore beds above the old Dolly-Ann, or Rough-and-Ready furnace, on the Douthat survey, is completed and this company will soon begin the mining and shiping of iron ores on a large scale. The ore beds are connected with the railway by an incline 1000 feet long. The president of this company is Capt. C. R. Mason, the well known venerable Virginia railway builder; its superintendent and engineer is Mr. J. J. Stack, Jr.

The following analysis of this ore, from sampling by Maj. D. Shanahan, was made by Dr. Henry Froehling, of Richmond, Va., April 25, 1883:

The sample was dried at 212 degrees, Fah., previous to analysis, and contains—

Ferrous oxide	0.018	
Ferric "	82.680	
Alumina	1.951	
Manganese	none	
Lime	0.420	
Magnesia	0 068	99.827
Phosphoric acid	0.949	
Sulphuric "	0.309	
Silica	3.260	
Water	10 172	
Metalic iron	57.89	
Phosphorus	0.4188	
Sulphur	1.133	

This shows a most excelent quality of limonite (brown hematite) iron ore.

Mispickel.—There has been a considerable excitement of late over the discovery in Irish creek, Rockbridge county, Va., tin region, of a heavy ore that was supposed to be silver, which the enthusiastic discoverers reported would assay $1,000 to the ton. We have seen fine specimens of this ore, and find it to be *Mispickel*, Arsenopyrite or Arsenical Iron pyrites, which usually consists, according to Dana, of, Arsenic 46.0 per cent, Sulphur 19.6, and Iron 34.4; a cobaltic variety contains 4 to 9 per cent of cobalt in place of part of the iron.

According to the recent volume of the U. S. Geol. Survey on Mineral Resources of the U. S, Mispickel on the Pacific coast is frequently auriferous and is treated for its gold. It is found, more or less, in every portion of the U.S. "and is often mistaken by farmers for silver ore."—Dana, (Mineralogy) says: "Arsenopyrite is found mostly in crystaline rocks, and is commonly associated with ores of silver, lead, iron, or copper." So silver ore may yet be found in the "tin belt."

Since the above was in type the following has come to hand:

Silver and Gold in Va. Tin-belt.—Under date of Nov. 6, 1883, we have from President Kimball, of Shenandoah Valley RR., the following statement from Prof. Andrew S. McCreath, chemist of Second Geol. Survey of Pa., concerning the *silver ore* from the tin-belt of the Blue Ridge in Rockbridge county, Va., near Vesuvius station of S. V. RR.:

"The ore is an argentiferous mispickel, consisting mainly of arsenic, iron and sulphur, with, in this case, a little lead. An assay of the sample sent me by Mr. Whitehead shows:

Silver, 38 ounces per ton, worth,	$43.70
Gold, 1-10 ounce per ton, worth,	2.06
Total value per ton,	$45.76

Adding, "This makes a good showing."

Victoria furnace Limestone quarry.—In the Lexington, Va., Gazette, we find the following account of the quarry, in the lower Helderberg (No. VI) limestone, from which Victoria furnace of the Iron and Steel-works Association of Virginia (Limited,) draws its supply of flux:

"Lime is one of the commonest of minerals and of the widest distribution, not only as a partial constituent of many rocks but by itself as a limestone. This mineral is found over continuous stretches of country for hundreds of miles in Virginia and other states. One of the most important uses to which it is put now-a-days is in the manufacture of iron. The Victoria furnace, near Goshen, makes use of about 130 of limestone in 24 hours. Its entire supply is obtained from the quarry near Bell Valley station of the Chesapeake & Ohio Ry. Twenty-five acres of land have been leased for 90 years from Mr. A. Bell, who receives a royalty on each ton of limestone taken out. The stone from this quarry is considered especially valuable in the reduction of ore, its analysis showing 89 per cent of carbonate of lime. The quarry is a short distance south of the railroad, with which it is connected by a branch track 1,100 feet long. Upwards of 250,000 tons of limestone have already been taken from this quarry. Eight gondola cars, capable of carrying 20 tons each, are daily loaded and sent to the furnace. A little more than the daily requirement is sent and kept at the furnace as reserve for seasons of particularly severe weather when operations at the quarry are necessarily suspended. Although an average of about 25 blasts are made per day, and on some days a much greater number, no serious accident has yet occured; this long immunity is something unusual and speaks well for the management. Forty men are employed at the quarry. Capable drillers and sledgers receive $1.15 per day. The cost of powder necessary for the removal of a solid yard of quarry rock is about 15 cents. Most of the above points were obtained from Mr. J. E. Vawter, the gentlemanly and efficient superintendent, under whose supervision the quarry has been since its opening a year and a half ago. Messrs. Boggs and Perkins are the foremen.

Gem furnace:-Iron-making at a Profit in 1883.—The new Gem furnace of the Shenandoah Iron, &c Co., at Milnes, Page county, Va., on Shenandoah Valley RR. (as we noticed on pages 1 and 6 of this volume) went into blast for the first time February 1, 1883. We have good authority for making the statement that during the first six months of this blast,—notwithstanding the losses of time and the delays incident to a first blast, including in this instance three weeks during which the furnace was banked up,—the cost of pig iron made, delivered on the cars, was $12.98 per ton; and the sales of the product of this period averaged $16.60 per ton at the furnace, leaving a clear profit of $3.62 per ton.

We have no return of the quantity of iron made in this time by Gem furnace, but a reference to page 84 of this volume, where its work for April is recorded, will show that during that month it averaged 54.5 tons a day. A Whitwell stove is to be added to the plant of this furnace at once, to increase its productive capacity.

Zinc in blast-furnace fumes.—Mr. Alfred L. Brainard, Supt. of Mines and Chemist of Low Moor Iron Co., Va., informs us that he recently analyzed the fumes in the "downcomer" of Low Moor furnace and found them to contain 70.78 per cent of zinc, or 88.20 per cent of zinc white.

The Intelligencer, of Wheeling, West Virginia, comments as follows on the statements of this list.

"The most noticeable feature of the business is the large increase in producing power, due to the enlarged capacity of old mills and the erection of new ones. In August of 1882 there were in the United States 68 nail mills having 4,267 machines. On the first of the present month—but fifteen months later—the number of mills is found to be 74, with 5,008 machines. Three establishments have abandoned the nail business and nine new mills have been built; a net gain of six mills and 841 machines, making a present annual capacity of 11,376,000 kegs. As we understand very well in this neighborhood the product is kept within something like reasonable bounds by suspension of operations. Still the price is not satisfactory to manufacturers, and yet the work of increasing producing power goes on.

The Bulletin has information of five new works being built, likely to be completed within the year, and these will add at least 200 machines. Then the old mills are to put in 391 more machines. So that, if present plans are carried out, by the begining of next year we shall have 5,599 machines turning out nails,—1,432 machines more than there were in August, of 1882. In other words, an increase of about 25 per cent in producing capacity in sixteen months. There is no such increase in the consuming capacity of the country. Seeing that production was already ahead of consumption, this large and rapid growth cannot be regarded with satisfaction. The new machines to be put in by January 1st, will add 1,000,000 kegs to the capacity, making a total of 12,376,000 kegs. In 1882, the year of greatest production, the mills of the country made 6,147,097 kegs.

The country grows in a year, but its ratio of increase is far behind that of the nail making capacity. Our manufacturers may see a brighter outlook, but if there be any relation between supply and demand the end of the enforced policy of suspensions is not near at hand.

It will be seen from the Bulletin's recapitulation table that Pennsylvania maintains her place at the head and is doing most in the way of increase. West Virginia is a good second in the matter of increase; and if we count the new machines to be set up in that part of Ohio included within the Wheeling nail district, the manufacturing community of which Wheeling is the centre will be seen to be holding its place with a firm hand. The growing importance of the Western and Southern mills will also be noted, for they are to play a part in the nail business."

The agreeable feature of the nail industry to the iron makers of Central Virginia is the demand it creates for their excellent pig iron, which now has a good and improving reputation among the Ohio river nail makers.

Flat-top Coke.—Commenting on the recent article in *The Virginias* concerning the use of coke for domestic purposes, the "Pocahontas Outlook" remarks as follows:—We cannot see why Connellsville coke, notwithstanding its great reputation, should not have in Flat-top coke a formidable competitor, even at points where both can be purchased at the same price per ton. And the fact (demonstrated by Mr. Howell,) of the superiority of coke over anthracite coal for domestic purposes, ought to enable the Flat-top coke to take the place of the large quantities of anthracite coal now sold in Virginia for such purposes. Presuming, and we think it more than probable, that coke will to a certain extent supplant anthracite coal, and that Flat-top coke will have a reputation equal to Connellsville coke, it is hard to say how great a demand there will be for that coke. No matter how great the demand, the S. W. Va I. Co. will, we should think, endeavor to fill it, which will necessitate a great enlargement of their work here, causing Pocahontas to spring from a town into a city. The demand may be larger than Pocahontas can fill, necessitating the further extension of the Railroad iuto the Flat-top coal field, in answer perhaps to the long and fervid prayers of the McDowell Progress for a railroad through that county.

The Mine Foreman's Pocket Book, by Thomas J. Foster, Editor of the Mining Herald, published by the Mining Herald Company, Shenandoah Schuylkill Co., Pa., has recently been sent us by the publishers. We find it in reality a pocket-book that a mine foreman would derive much benefit from by having it always at hand; it is replete with tables of interest to those engaged in coal mining, gives excelent rules for mine surveying and notes and hints on mining, ventilation, safety lamps, heat, strength of materials, machinery, specific gravity, etc.; together with chemical and other useful memoranda.

We notice one or two things in this volume that should be corrected:

On page 14 the *area of the coal fields of Virginia* is put down at "185 square miles." Virginia has over 150 square miles in her Jura-Trias coal fields, commonly called the Richmond coal field, and over 1,000 square miles of the great Trans-Apalachian bituminous coal basin of the Ohio, (usually called the Apalachian coal basin,) in the counties of Tazewell, Russell, Buchanan, Wise, Dickenson, Scott and Lee, as well as about 1,00 square miles of patches of the anthracite and semi-anthracite coal of the Apalachians; so that her coal area should be stated as *over 1200 square miles*, or a tenth as much as Pennsylvania.—The table of *analyses of American coals* is not a fair one, as it gives but one analysis of W. Va. coals, a cannel from Boone county, (the Peytona, we suppose, a mine that has been worked out,) which contains 41 per cent of fixed carbon, 13 of ash and 46 of volatile matter, and gives none of the noted and widely used bituminous and semi-bituminous coals of that state.

Lumbering on Ches. & Ohio Ry.—We learn that Mr. J. K. Mohler, who has a steam saw mill near Quinnimont, W. Va., on line of C. & O. Ry., is now sawing tulip-poplar and ash timber from the lands of Mr. A. A. Low, of New York, on Mill creek, which flows into New river from the south, from Raleigh county, a few miles above Quinnimont. Only timber of 15 inches or more in diameter is cut. A stumpage of $4 per thousand feet b. m. is paid and some 2,000,000 feet will be cut from the boundary of land, some 900 acres, held by Mr. Low. Some single poplars pay from $21 to $25 stumpage, showing how few fine trees it takes to make these West Virginia coal and timber lands pay for themselves. The logs delivered at the saw mill cost from $7 to $10 per M. b.m., and the lumber cut from them is worth from $18 to $20 per M. on the cars.

It will be noticed that only the large trees of two kinds of timber are cut from these lands, leaving not only an abundance of timber for all future coal mining operations, but also a large quantity of saw timber of other kinds of trees.

Fire-brick are to be used for a street pavement or road bed in one of the principal streets of Wheeling, W. Va., one of the fire brick manufacturers of New Cumberland having donated bricks to the city for that purpose.—The experience of Charleston and Wheeling with brick road beds has been very satisfactory. It is expected that fire brick will prove even better adapted to this use than common ones.

Railways and County subscriptions.–In the Wheeling Intelligencer of Nov. 2, we find the following sensible editorial; other counties in W. Va. and Va. may give heed to such advice greatly to their advantage:

Senator Camden, in a letter to the Gilmer County Railroad Company, published in part in yesterday's Intelligencer, devoted some attention to well-considered remarks on the matter of county aid. Having suggested that Gilmer county could afford to subscribe $100,000 for a narrow-gauge road to be run through her own territory, Calhoun, Roane and Jackson to the Ohio river, Senator Camden followed up the suggestion with this very business-like statement:

The annual interest on such a subscription woud be $6,000, and say $1,500 to create a sinking fund to pay the principal in thirty years, making $7,500 per year. The tax on the railroad when completed would pay to the county about one-fourth of the interest on the subscription. The road would distribute several hundred thousand dollars in the county while building, and a considerable amount each year afterwards in its maintenance and operation. The value of property in the county would not only largely increase, but the railroad would bring population and purchasers. The increase of taxable values of the property in this county, and the increase of population and business enterprises, would in a reasonable time, not only reimburse the county for the amount to be paid, but leave a surplus in favor of the county by reason of the investment. In addition to this, each tax payer would directly or indirectly be more than compensated by the general advantages and thrift created by furnishing markets for the surplus products of the county which are now wasted for want of transportion, and by the increased production from the encouragement to produce. Easy transportation furnishes a demand for everything that is produced and gives an incentive to production.

I will venture the opinion that the destruction and waste of timber in clearing up lands in Gilmer county would, of itself, pay such a subscription each year.

In other words Gilmer connty can afford to subscribe what seems to be a large sum of money, make it all, interest and principal, out of the railroad though it never paid a dividend, and have left a handsome balance in the enhanced value of every foot of land and of every business enterprise in the county. The same reasoning applies to the other counties through which it is proposed to construct this important highway.

These county subscriptions would not build the road, but they would help, and they would perform the essential part which induces outside capital to come in and help those who show a determination to help themselves. As Senator Camden has well said, "Trunk lines connecting large commercial centres, and requiring large capital, are built without reliance on local aid, but local roads must have local aid to give security and confidence to outside capital."

Gilmer, Calhoun, Roane and Jackson are counties well endowed by nature. They need only frequent and rapid connecting with the great highways of traffic to put them on a level with the most favored. Their opportunity seems to have come. It is to be hoped that they have the "enlightened selfishness" to embrace it, and that promptly. Progress is knocking at their doors, ready to enter and scatter its blessings on every hand.

Mining and Geological Excursion to Va. and W. Va.—In "The Tech," the journal published by the students of the Massachusetts Institute of Technology, Boston, Mass, we find the following interesting diary of the excursion made to the Virginias, last summer, by the mining and geological class of that institution, by one of the students, Mr. D. We- son.

Sunday, June 17. We did not go to church because th- hotel fare was not of a character to arouse pious sentiment- Some one said the initials E. L. & B. S. RR., displayed o- a car before the door, meant "Eat Little and Be Satisfied. The first part only was easily accomplished.

Early Monday morning the well-known editor of *Th- Virginias* and celebrated geologist, Maj. Jed. Hotchkiss, ap- peared and conducted the party into the "Iron Gate," wher- we received a lecture on geology long to be remembered - The gate is a break in the mountain, through which th- Jackson river passes, about three hundred yards wide a- the bottom, with bare, almost perpendicular rocky walls rising to about one thousand feet above the river, the strata of rocks bent from end to end in magnificent rainbow arches. The gorge makes a grand lecture-room for geology. Here are exposed the formations III. to VIII., inclusive, of Rogers' classification, or as we should say, all the Upper Silurian and part of the Devonian rocks.

June 19 was spent at Low Moor. Under the guidance of Major Goodwin we inspected a one hundred and twenty-five ton furnace, after which, under the charge of the mine superintendent, Mr. Brainard, we saw where the ore came from.

The great event of the day was the exploration of a newly opened cave in the limestone quarry which supplies the flux for the furnace. To enter, we scrambled up about thirty feet of perpendicular rock, holding on to ropes which gave indications of weakness. Squeezing through a narrow opening, we entered a realm of mud and darkness. Half an hour's groping, with the aid of a few candles, put us in possession of some magnificent limonite and arragonite stalactites and transformed us into the mudiest crowd ever beheld.— We enjoyed ourselves that night at the "White Sulphur." The waters smell strongly of H S, and remind us too much of the laboratory to be palatable.

June 20. Quinnimont was reached at noon. Here the iron furnace, coke ovens, and coal mine were examined and the party hospitably entertained by Mr. Lewis, the manager.

June 21. Pushed on to Blacksburg, W. Va, where we made our head-quarters till the 26th. Excursions were made to each of the various points of interest in the neighborhood. A trip down the Kanawha gave us a chance to examine the government system of locks and dams.

The same day we visited the Mercer coal mine and enjoyed the collation furnished by the managers.

East Bank mine, belonging to Mr. S. M. Buck, absorbed our attention one forenoon, while at a party given in our honor by Mrs. Buck in the afternoon, we became aware that West Virginia produces charming young ladies as well as "splint coal."

Starting from Charleston, eighteen miles distant, we took a twenty-mile horseback ride, ostensibly to visit the "black band" iron ore deposits at Davis creek, but really for the sake of the ride. We saw the ore, but many of us concluded that night that horseback riding over rough roads was more romantic than comfortable.

The last day of our stay in West Virginia we visited the Kanawha salt works and bromine factory at Malden. The latter turns out seventy-five pounds of bromine per day.

The evening of June 27 we reached Luray and visited the famous cave. The next day three of the party went south and the remainder reached Washington, where they scattered.

During our short visit we found that naturally Virginia is a state remarkably adapted to the manufacture of pig iron. With her coal, ore, and limestone in close proximity to each other, she requires but capital, science and enterprise to make her a rival of Pennsylvania.

Western and Southwestern Virginia are splendidly adapted to stock raising, while the forests of that section abound in the choicest lumber. Already saw-mills are making havoc, and if preventive measures are not taken the hills will soon lose their most valued treasures and greatest attraction.

D. W., '83

Washing and Separating Iron Ore.

The object of this article is to attract the attention of large ore producers to the quantity of good ore lost by the ordinary process of washing fine ore. There is a large quantity of fine ore produced in Virginia which requires washing to clean it from sand, clay, flint and sandstone.

Most of this "fine" or wash ore occurs naturally in the vein in a fine state of division, or becomes so when loosed by the pick or gad, besides smaller quantities which occurs in handling lump ore, which is ground off by the friction of the lumps against each other in loading and unloading, also produced in blasting down the hard ore in the breasts of tunnels and open cuts.

There are several styles of Washers which will clean ore from its impurities and foreign matter. Among the most prominent are the "Thomas" or "Shaft Washer" and the "Rotary" or "Boiler Washer;" the latter seems to be generally prefered, owing to its cost being less; but the former, while it will cost more, has the capacity of washing a greater quantity of material and many think that it cleans the ore much better. The repairs on the Shaft washer are perhaps more expensive and more extensive, while, if the Rotary washer wears out an almost new plant will have to be purchased and the first cost repeated, and that within a couple of years after erection.

Neither washer above described seems to do anything more than merely clean the ore from sand and clay, the sandstone and flint is picked out by men or boys on the "apron" of the washer before it goes into the shute. At some places a screen jig is played to separate the sand that comes out with the washed ore from the very fine ore that also passes out of the washer into the large screens; this ore and sand is washed into an independent sluice trough and first passes into a revolving screen and from this is carried into a screen through which, by a cam movement, it is shaken out on the floor and separated from any fine sand or clay that does not pass the smaller screens. In runing through some 500 tons of material there would be saved about 25 tons or 5 per cent of fair ore, not however perfectly free from small pieces of flint and sandstone of the same size as the ore. In a series of experiments made during the month of Oct. by the writer, this was ascertained by using riffles in the main sluice trough which carries away all sand and clay from the washer and "jigger screen." These riffles were placed over ten feet, and there were 3 sets of them. It was found that 5 tons of good ore that passed the jigger screen was saved in one day or one per cent of the whole. This ore was of a size that would pass through a 20 to 40 meshes to the inch screen or seive, and had 6 per cent more iron in it than the one that went into the washer and only contained 8 per cent less iron than the jiggered ore. There is, besides this ore now wasted, a still finer ore, so fine that it would pass through a seive having from 50 to 60 meshes to one inch and is very rich in iron; it corresponds to the slimes of silver and copper ore that are treated for the metal they contain.

There is no way of saving this ore except by using a "slime table:" riffles will not catch this "slime" and it is hard to estimate the quantity, but it would probably amount to at least 8 tons with the above stated quantity of material. This would make a total of 8 tons of 55 per cent iron in the ore saved in one day, which at $2 per ton would be $16 per day, and in one month $416, in one year $3,792 saved.

In order to get a uniform product averaging 8 tons of 55 per cent ore, we would have to purchase some improved jig like the Roggue 3 compartment jig, costing about (delivered) $400.00

A Slime table or concentrator for very fine ore, costing (delivered) about	800.00
Seting up and attaching to washer, about	200.00
Total cost of improved machinery set up	$1400.00

This amount deducted from the amount of saving of $3,792, would leave a net saving of $2,392 in a year. These figures are only approximately correct, but will go to show the importance of saving what is now wasted in the usual treatment of iron ores.

Alfred F. Brainard, A. C. & M. E.,
Supt. of Mines, Low Moor Iron Co. of Va.

The Naturalists' Field Club of John Hopkins University, Baltimore, Md., composed of students of that university, has this year been reorganized and divided into zoological, geological and bontanical sections, so that the special work in the field may be more fully and better done.—Every one of our colleges and universities that pretends to teach natural science should see to it that its students are similarly organized and drilled in such field work. Most men are sadly deficient in their observing powers and in no way can these be so well trained and improved as in the intelligent field study of the natural sciences.

The account of a day's work by this club, in the Baltimore Sun of Oct. 29, is full of interest.

Ship-building.—The Baltimore Journal of Commerce commenting on an article from the N Y. Ship. & Com. List, on the decay of wooden ship-building in the U. S., which stated that this industry now flourishes only in Maine, chiefly at Bath, which brings from Virginia and other Southern states the oak and pine used in constructing ships,—goes on to say that the same character of vessels can be made in Baltimore $5,000 cheaper than in Maine. Why cannot this industry be revived in Virginia, where ships can be made as cheaply, at least, as in Baltimore.

Sale of W. Va., Coal Lands.—The New York Tribune and the Baltimore Sun report the sale of the oil and mineral rights on 80,000 acres of land in Gilmer and Braxton counties, W. Va., to Pittsburg capitalists, for $500,000; and that boring for oil under the management of James Lusk, of Pittsburg, will commence at once.

The Baltimore Sun, confessedly the model news-paper of the South, is always saying and doing handsome things, but it never did a more handsome one than it did recently by sending its exchanges a splendidly executed photo of Mr. A. S. Abell, its founder and owner, on a background of a reduction of the first page of its issue of August 10th. It will do any editor good to have such a likeness of such an honest-faced man look down upon him during the labors of his office. Thanks for the picture and good wishes for "The Sun."

The Brush Creek Gold mines.—The Floyd Reporter states that a portion of the Brush Creek gold field, in Montgomery and Floyd counties, Va., has been sold to some Pa. capitalists for $15,000; and that the purchasers will soon put there a 40-horse power engine and a 10-stamp mill and commence regular mining work.

Three Decades of the Growth of Virginia.

(Continued from page 149.)

Virginia as a Dairy State.—One of the first questions asked by the wise seeker after a home in a country new to him, is whether it is a "grass country," and whether "milch cows" will flourish there; for none of the animal products of a country are more esteemed by the prudent husbandman than those of the dairy, and few things contribute more to the comfort and physical vigor of the people than an abundant supply of milk, butter and cheese; hence the dairy statistics of the state are matters of general interest.

Before presenting the tables of Virginia's dairy industry for the decades of 1860, 1870 and 1880, we may remark that dairying as an occupation has never been entered upon to any considerable extent by our people; they have been content, as a rule, to have an abundance of milch cows—a very large number in proportion to the population—for their own use and have only marketed what remained of their products after the wants of their own households have been bountifully supplied. The neglect of dairying as an occupation was not in consequence of any want of adaptation to that business in the soil, the climate, or the location of the state, for all these are favorable; nor was it because there was not sufficient promise of profit in it, for enough has been done to show that it could be made one of the most profitable industries in the state.—The writer well remembers the infancy of the now great dairy industry of the state of New York; it grew with the growth of the railways. Virginia has, in one part and another of her greatly varied domain, just as good conditions for dairying as any portion of New York, along with vastly better ones of climate; and when the proper times comes, as come it will, she, as well as her sister state, West Virginia, will rank with the leading dairy states of the Union.

Few people seem to be aware of the fact that fully half of the land surface of Virginia, over 21,000 square miles, a territory nearly three times the size of the state of Massachusetts, is a natural grass country, a large part of it the *original blue-grass region* of the United States, the one from which blue-grass spread westward to Kentucky and elsewhere, when and as the people of Virginia spread. The Piedmont, the Blue Ridge, the Great Valley and the Apalachian grand divisions are, as to almost their entire areas, natural grass regions; country where permanent grass will grow, or can be easily made to grow, whenever the land is cleared of forests and its surface exposed to the sun. All of it is within the grass-growing isotherms. Geographically it lies between 36°30′ and 39°30′ of North latitude; but it offers a range af altitudes anywhere between 200 and 5,600 feet above sea-level, or an actual climatic range equivalent to from 37° to 57° North latitude: or your choice between Cape Charles of Virginia and Cape Charles of Labrador—and beyond.

Given this range of climate from latitude and elevation and an abundance of moisture from its relations to the gates of the sea and the reservoirs of the mountains; then add a great variety of soils resulting from the already profound but ever-continuing decay of rocks rich in alumina, silica, lime, potash, and other matter for plant food, it would be passing strange if much of Virginia were not admirably suited to become the favorite home of the dairyman.

In Midland and Tidewater the cultivated grasses flourish under proper tillage, and those extensive regions have especial adaptations for growing all the varieties of clovers, peas, beans and other forage plants, such as few regions can offer for stall or yard dairying with cut green forage for a large portion of the year.

The following tables present the statistics of the dairy in Virginia, at each census of the three decades under consideration, by grand divisions.

1. Number of Milch Cows.

	1860.	1870.	1880.
Tidewater	43,876	34,197	41,516
Midland	63,564	44,151	59,654
Piedmont	46,681	39,052	52,728
Blue Ridge	6,805	7,902	10,850
The Valley	44,643	41,041	46,336
Apalachia	25,090	22,128	28,777
Virginia	230,659	188,471	243,061

These figures show, in a very striking way, the damages that the long civil war of 1861–5 inflicted on the people of Virginia. Their kine wealth *decreased* more than 40,000, or over 18 per cent, between 1860 and 1870; their wonderful recuperation is more strikingly shown by the *increase* of this wealth nearly 60,000 head, or about 32 per cent, between 1870 and 1880.—The natural grass grand divisions had in 1880 not only recovered the numbers of milch cows they held in 1860, but had made large additions. Although Tidewater and Midland did not in 1880 recover the numbers of 1860, their gains were proportionately greater.—The losses of each grand division represent the extent to which it was the theatre of war.

The following table shows the number of milch cows to each 100 of the population in the grand divisions of Virginia and in the states named, in 1860.

2. The Number of Milch Cows to each 100 People

Tidewater ... 13	The Valley.... 23	Middle States ... 24
Midland 17	Apalachia 32	Western States.. 27
Piedmont..... 22	Virginia 20	Southern States.. 29
Blue Ridge... 28	New Eng States 21	United States ... 27

These figures give a good idea of the distribution of milch cows in each of the grand divisions of Virginia as compared with the groups of the states of the Union. In England in 1874 there were 9 cows to each 100 of her population.

The following table shows the quantity of butter produced in each of the grand divisions and in the state at each decade.

3. Pounds of Butter made.

	1860.	1870.	1880.
Tidewater	1,085,671	531,960	1,092,152
Midland	1,911,902	1,434,255	2,617,391
Piedmont	2,816,054	1,718,231	2,836.426
Blue Ridge	269.416	285,616	574.110
The Valley	2,463,400	2,146,939	2,851.535
Apalachia	736,505	864,268	1.377,543
Virginia	9,322,948	6,979,269	11,470,923

The above returns show a large falling off in the production of butter in 1870 as compared with 1860 in all the grand divisions, except the Blue Ridge and Apalachia—the mountain divisions; but its most noteworthy feature is the production of 1880 as compared with 1870 or 1860; for each division not only made enormous gains on its product of 1870, but each one largely surpassed that of 1860, showing that in the general recuperation of the state not only had more attention than formerly been given to dairying, but that better results had been obtained.—Between 1860 and 1870 the production of butter in Virginia fell off 2,343,679 pounds, or over 25 per cent; but between 1870 and 1880 it gained 4,491,654 pounds, or over 64 per cent. The butter production of Virginia in 1880 was 2,147,975 pounds, or over 23 per cent more in 1880 than it was in 1860.

bed the Southwest Virginia Improvement Co., is successfully mining on the adjoining property to the south at Pocahontas.)

The bed there shows the following thickness:

Coal, bony,	8″
Coal, with slate	4′ 8″
Slate	½″
Coal	6′ 0″
Slate,	3″
Coal,	1′ 0″

On E. fork of Simmons creek, near where the coal goes under the creek, it shows:

Slate roof	
Coal, with a small amount of slate,	1′ 9″
Fire clay	4″
Coal,	2′ 6″
Slate,	¼″
Coal,	3′ 6″
Fire clay,	1′ 0″
Coal,	0′ 2″
Fire clay floor,	

On the West fork of Flipping creek, it shows:

Slate roof,	
Coal,	1′ 9″
Fire clay,	11″
Coal,	6′ 5″
Fire clay floor,	

From there down Flipping creek, near where the property line crosses the creek, the coal shows:

Coal,	2′ 6″
Slate,	10′ 0″
Coal,	2′ 2″
Slate,	¼″
Coal,	3′ 8″

On Crane creek, ½ mile below Tolliver branch, the coal shows:

Sandstone,	10′ 0″
Slate,	3′ 0″
Fire clay,	2′ 2″
Coal,	4′ 11″
Fire clay,	0′ 7″
Coal,	0′ 8″

At the mouth of Tolliver branch the bed has been partially opened, showing the main bench 4′ 11″ thick.

At the head of Godfrey branch of Widemouth, the coal shows in the bed of the creek:

Coal,	0′ 2″
Fire clay	0′ 2″
Coal,	5′ 0″
Fire clay,	0′ 2″
Coal,	0′ 6″
Fire clay floor,	

Near the head of Meadow fork of Rich creek the coal shows:

Coal	1′ 8″
Slate,	0′ 2″
Coal,	3′ 6″

A few hundred yards from where Rich creek crosses the property line the coal has been opened and shows:

Slate roof	
Coal,	2′ 5″
Slate,	0′ 2″
Coal,	1′ 9″
Fire clay floor	

On a branch of the North fork of Elkhorn, west of Windmill gap, the coal shows:

Slate roof	
Coal,	4′ 6″
Slate,	0′¼″
Coal,	10′ 0″
Fire clay floor,	

On the South fork of Elkhorn, at the northwest corner of the property, the coal shows:

Sandstone,	
Slate,	10′ 0″
Fire clay,	0′ 6″
Coal,	7′ 0″
Fire clay	0′ 1″
Coal,	1′ 0″

Coal bed No. 4 has been opened at a few places; it is about 80′ above No. 3; the bed has from 4′ to 4′ 6″ of coal in one solid bench.—Coal bed No. 5 is 100′ above No. 4; it has also been opened in a few places; it shows from 3′ 6″ to 4′ of solid coal in one bench.—The other beds, 6, 7, and 8, are too thin, where opened, to be mineable.

Coal No. 3 has been analysed by Mr. Andrew S. McCreath, Chemist of the Pennsylvania Geological Survey, from a sample taken by himself from the mine at Pocahontas, with the following result:

Water,	9.932	100.000.
Volatile matter,	29.738	
Fixed carbon,	73.728	
Sulphur,	0.618	
Ash,	3.984	
Phosphorus,	0.0013	

The coal has a columnary structure separated by layers of mineral charcoal. It mines out in good sized lumps with the average amount of slack.

I have riden on an engine over the New River division of the Norfolk & Western Railroad and seen the coal used. It is as fine a steam coal as can be found on any railroad, making a clear strong fire, with no clinkers, the ash being small in amount and easily removed. The coal has given great satisfaction among the railroad men who have used it.

The map and cross-sections accompanying the report show the outcrop line of bed No. 3, and the two sections show the manner in which the coal beds pass through the property. Coal bed No. 3 underlies almost the entire area of the property; only enough of it has been eroded by the creek to make it accessible at every point by drifts above water level, rendering the mining, drainage and ventilation of the different collieries safe and cheap. These creeks cuting back into the coal have the advantage of allowing numerous collieries to be started at different points on the property. Coal beds Nos. 4 and 5, being higher on the hills, do not underly as much of the property, their acreage being from one-half to two-thirds of the area. Without having measured the exact area of the different beds, the enormous amount of coal the property contains can be stated in the following manner:

Coal bed No. 3 has 10,000 tons of coal to the acre and underlies from 40,000 to 45,000 acres.

Coal bed No. 4 has 7,000 tons of coal to the acre and underliess about 30,000 acres.

Coal bed No. 5 has 6,000 tons of coal to the acre and underlies about 25,000 acres.

The lower (S. W.,) end of the property can be opened by building 6 miles of easily-constructed railroad. To open up more than one mine will necessitate the extension of the railroad down the river and up the various creeks.

With the exception of the few clearings made by the small farms on the property, the land is well timbered, the timber being white oak, hemlock, chestnut and poplar; the white oak and hemlock are the best on the property.

I consider that the property is very valuable for the following reasons:

Its nearness and accessibility to a completed railroad; the ease and cheapness with which collieries can be constructed and coal mined from them; the superior quality of the coal as as steam coal and also as a good coking coal; and also because the property has an enormous amount of coal on it.

Yours respectfully,

Richard H. Sanders, Geologist.

Precious stone finders foiled.—In the mining columns of the New York Produce Exchange we find the following statements, which will apply to other localities that we know of:

Mr. James M. Smith, of Gibbonsville, Guilford county, N. C., while ploughing on his farm in March last, turned up an irregular-shaped smooth-faced stone the size of a hen's egg. It glittered in the sunlight. Mr. Smith took the stone to Greensboro, where a jeweler pronounced it a genuine emerald, weighing nine ounces. The jeweler was also of the opinion that smaller brilliants clinging to the central stone were diamonds

The fact was published and aroused the greatest interest among jewelers and mineralogists. A diamond miner visited Mr. Smith and offered him $1,000 for the gem. Mr. Smith refused the offer, being assured that the emerald was the second largest in the world and of immense value. He brought it on to New York and entrusted it to Mr. Robert W. Donnell, a banker, of No. 102 Broadway. Mr. Donnell took it to Tiffany's, where it was given to Mr. Geo. F. Kunze, the firm's expert, for examination. His report was read before the last meeting of the New York Academy of Sciences. Mr. Kunze said that after subjecting the stone to various tests he found it to be a crystal of quartz, penetrated by long hair-like crystals of green actinolite or byssolite, and containing strings of small cavities filled with liquid. It was only valuable as a mineralogical specimen for cabinet purposes and was worth for such use about $5. The report was accepted and the crystal was yesterday returned to Mr. Donnell to be sent back to the expectant Mr. Smith.

At the same meeting of the Academy, Mr. Kunze reported on the "Georgia Marvel," or the "Blue Ridge Sapphire," as it is called, which was found a little over a year ago in a brook in that state. The stone weighed about half an ounce and was supposed to be worth about $50,000. Its discovery created even more interest than did that of the North Carolina emerald. Two well-known Southern jewelers asserted that it was genuine, and it was sent here for crucial test. Mr. Kunze said that, after a short examination, he found it to be a piece of blue bottle glass which had been rolled in the brook until the action of the water and gravel had polished it to an unusual brilliancy. Mr. Kunze was obliged to glaze or enamel a piece of platinum wire with a fragment of the "sapphire" to convince the owner that it was glass. If it had been a genuine stone it would not have been possible to do this, a sapphire being non-fusible.

November Weather Laws in the Virginias.—In the November bulletins of the U. S. weather-service is published the following:

For the Middle Atlantic states, during the month of November winds blowing from the Southwest to Southeast, or from directions between these points, are found to be winds most likely to be followed by rain or snow. Winds blowing from the North or West, or from directions between those points are found to be the winds least likely to be followed by rain or snow.

For the station at Washington, D. C., and for the month of November, mean barometer corrected only for temperature and instrumental error, 30.099: mean barometer reduced to sea level, 30.217: mean monthly range of barometer, 1.120: mean temperature, 43°.8: highest since commencement of observations, 80°.0 in 1879: lowest since commencement of observations, 12°.5 in 1880: mean monthly range of temperature, 47°.3: mean precipitation, 2.97 inches: prevailing wind Northwest.

"**Mineral Resources of the United States,** *by Albert Williams, Jr., Chief of Division of Mining Statistics and Technology,*" is the title of a handsome volume of 813 octavo pages, replete with the information its title calls for, from the U. S. Geological Survey of which Major J. W. Powell is Director.

We have long needed in this country an authoritative annual report on the mineral resources of all parts of the country, as made known by the yearly progress of research and development, and of its mining statistics, the results of work done during each year, such as are published by other countries; therefore we welcome the appearance of this well filled volume, one that quite successfully, considering the difficulties attending the preparation of a first report of this kind, presents the facts of our mineral resources and their development, not only as made known by the census of 1880, but brought up to the current year by the special researches of the U. S. Geological Survey This volume will prove very valuable for reference and for a guide to those seeking information. Its prompt and full publication of recent mineral and mining facts reflects credit on the management of the Geological Survey and furnishes evidence of the wisdom of Congress in extending that survey over the whole domain of the Union.

After this general commendation of this report we are in duty bound to call attention to all its short-comings, in so far as we can discover them, in its statements concerning the mineral resources of Virginia and West Virginia; not for mere criticism, bnt to aid, by suggestion and information, in helping to give greater accuracy to the annual volumes that we hope will follow this. In this issue we have only room for the following comments; others will follow:

Coal.—The remark that "of bituminous coal, the state of Pennsylvania posseses large quantities, it being found in almost every county west of the Alleghanies," is rather partial, as the same could have been said of West Virginia, with the addition that it has a larger area of the coal measures, and more and thicker beds of coal.

The coal area in Virginia is stated, page 5, as 185 square miles; an inexcusable repetition of the incorrect statements of other works, such as we call attention to on page 170 of this number, where this area is correctly stated as over 1,200 square miles instead of 185.—We say this statement is inexcusable, especially when made by one that writes as an expert, because the "Summary of Virginia," thousands of copies of which are scattered all over the country, furnishes the correct figures for any one searching for such information.—We know the editor of this volume will say that the 185 square miles of his statement is the "Richmond coal field," and that Virginia's portion of the coal basin of the Ohio (the Apalachian) is included in his "West Virginia section;" but the fact remains that the impression left with the reader is that Virginia has but 185 square miles of coal territory.

The figures of production of coal in Virginia and West Virginia, on pages 6 and 7, are, to say the least, confusing.—On page 6 the production is given as follows, in tons of 2240 lbs., "not including local colliery consumption," without stating whence derived:

	1880.	1881.	1882.
West Virginia,.	1,400,000	1,500,000	2,000,000
Virginia,.....	1,00,000	100,000	100,000

On page 7 the productions for the census year ending May 31, 1880, in tons of 2000 lbs, are given thus:

West Virginia, bituminous,.....	.....	1,839,845
Virginia, anthracite,....	2,817	 45,896
Virginia, bituminous,..	43,079	

In Mr. Chas. A. Ashburner's report on anthracite coal, page 32, is this statement concerning the *Dora coal field*: "Of one of the reported anthracite localities in Virginia, that in Augusta county, recent tests with the diamond drill would seem to prove the presence of anthracite. Three holes were put down by the Pa. Diamond Drill Co., in North River gap, two on the Pyron (Pryor?) land to a depth of 914 feet, and one on the Davis land to the depth of 167 feet.

Result of borings in Augusta county, Va:

Near the surface,.....10 feet of fire clay.
At 25 feet,.....13 inches of coal.
At 40 feet,.....21 inches of coal.
At 56 feet,.....36 inches of coal.
At 70 feet,..... 8 feet of coal.
At 125 feet,..... 5 feet of coal.

Thence to 914 feet, where red sandstone was struck, several minor seams of coal were passed through. The coal is said by those who have seen it to be true anthracite coal."—It is to be regreted, for the true interests of Virginia, that publicity should be given in a report from the U.S. Geological Survey, to such a statement as the above without comment. The measurement of the "cores" of the above "Result" by Prof. Fred P. Dewey, Curator of Metalurgy in the National Museum, which have been widely published, and which must have been known in the "Division of Mining Statistics" of the U. S. Geological Survey," do not warrant any such "Results." If presented at all both the published statements should have been given to guard the investing public from being misled.

Virginia and New Orleans Cotton Exposition.—We see in the Balt. Sun of Oct 27 that a representative of the N. O. Times-Democrat has just returned from a visit to the Governors of Georgia, Kentucky, Louisiana, Mississippi, N. Carolina, South Carolina, Tennessee, Texas and Virginia to interview them, in order to obtain from them their views relative to the coming World's Industrial and Cotton Centennial Exposition to be held at New Orleans, and to discover what aid and assistance their states will give to that enterprise, and what manufactures, minerals, woods. etc., the South has to place on exhibition before the world. In every instance these Governors gave a cordial and earnest indorsement to the proposed exposition, and a promise of aid and assistance to assure its success. Gov. Cameron said the proposed exposition was most kindly regarded in Virginia, and said he would do all in his power to make Virginia's exhibit in New Orleans worthy of the state. With the necessary appropriation from the Legislature, Gov. Cameron proposes to have the products of the factory, the mine, the forest and the field so classified and grouped that not only will the uses and purposes of each article be shown, but they will be so arranged that each section, the mountainous, the midland and the tide-water regions, may be recognized. Everything that Virginia produces will be sent, and a bureau will be established to take this matter in hand should the Legislature concur, of which he has no doubt.

Japanese Persimmons. – We notice a magnificent specimen of this new fruit on exhibition by Mr. Percy in the window of the Home Savings Bank. There are four large persimmons upon one twig, ripe and luscious, resembling large oranges or tomatoes. The little tree which bore them has thirty more upon it, and may be seen at the Brambleton floral gardens. A single one grown by Mr. John B. Whitehead upon his farm is shown weighing nine and a half ounces and measuring eleven inches in circumference. So much for our fine climate.—*Norfolk, Va., Virginian.*

Mineral Resources of Blue Ridge Plateau.

(Continued from page 167.)

nace once worked at Rocky Mount. In both bands the ore occurs, as is so commonly the case with the minerals of value found in this group of rocks, in the form of impregnations and replacements of the country rock. This rock is here a hornblendic mica schist, graduating into hydromica schist. The ore accordingly dips and strikes with the country rock. It does not form a clean-cut and distinct bed of ore, but, as is the case with all of the impregnating and replacing minerals of this part of the state, gives all degrees of purity from pure rock to pure ore. For this reason it is difficult to assign any definite thickness to the workable ore. It may be taken as varying from 2 to 4 feet.

A good deal of hornblende is sometimes associated with the ore, or is mixed with it. Very commonly some Pyrrhotite is mixed with it also. This latter is found below water level. Within 20 to 30 feet of the surface, this has been removed by oxidation. This pyrrhotite is very prone to oxidize. An exposure of a few weeks will show on the surface of the fresh ore, an efflorescence of sulphate of iron.

The furnace that was formerly in operation at this point, and which used this ore, had the reputation of making excelent iron. It was highly valued for all the purposes for which wrought-iron is used. I am indebted to Mr. Richard Saunders for an acconnt of the operations of this furnace. Mr. Saunders had much to do with the later working of it. According to him, the furnace was among the oldest in the state, and was started as far back as the time of the Revolutionary war. It was worked steadily up to the year 1850. In this year it was stoped, but operations were resumed during the late war. It was always a cold blast, charcool furnace, and made about 4 tons of iron per day. Only the outcrop of the ore, for about 20 feet down, was used, as this only gave the most easily managed iron, with the appliances then used. The iron made from ore below water-level was very fluid in the furnace, but gave trouble from cooling too rapidly when drawn into the molds. After weathering, however, the ore from greater depths acted like ore from the surface. This seems to indicate that the trouble was caused by the pyrrhotite that was present in the fresh ore. The thickness of the deposit ranged from 2 to 4 feet.

The Magnetite deposits at Rocky Mount are continued in a southwest direction through Franklin county into Patrick county. They, however, appear to show themselves in workable amounts only at long intervals, and at very few localities. Mr. Saunders states that at a locality in Franklin, about 10 miles southwest of Rocky Mount, and on the prolongation of the strike of the Rocky Mount ore, he and his brother erected in 1857, an iron furnace to utilize the ore of a deposit found there. This deposit was of magnetite, several hundred feet long and forty feet wide. It seemed, however, to be only local with this development. The Hairston ore deposits in Patrick, have a considerable reputation for extent and quality. I did not visit them, but have no doubt that they form another outcrop of this line of deposits.

Soapstone at Rocky Mount

The so-called soapstone found at Rocky Mount, is of the same general nature as the material that is generally known by this name in this section, and is very abundant in some parts of Franklin, Patrick and the Plateau counties. It is really a variety of mica schist, and is associated intimately with the normal mica schists of the region. It often forms a pretty well defined band. The peculiar properties of the rock, in virtue of which it can be worked with tools, are due to the fact that it is composed mainly of mica that is felted

diffused as a fine dust. Sometimes the particles of the minerals, including the hornblende and quartz, become larger, better crystalized, and more distinctly separated. In such cases the beding of the rock, or its lamination, is apt to become thicker and heavier, and then we often find some feldspar making its appearance, causing a variety of gneiss. In some cases a true hornblende schist is found. It is noteworthy that, although these strata have the character considered as marking the Huronian, they, both here and in the Plateau belt, are deficient in the epidotic and chloritic schists, that so constantly mark the supposed Huronian of the middle and northern parts of the state.

The dip varies from 35° to 70°. The very high dips are rare. The low dips occur generally in the more massive strata, and the high ones in the finer grained and more slaty beds. The strike ranges from 35° to 60° E. of N.; 50° E. of N. may perhaps be taken as the prevalent strike. The extremes are due to local flexures.

About 2½ miles from Rocky Mount a quite heavily beded hornblende schist is met with. Two miles from the foot of the Blue Ridge, and near Mr. Peter Saunders' place, the soapstone variety of mica schist occurs in a wide band. This is perhaps the same band with that occuring at Rocky Mount, it being repeated here. Some of it works well, and makes a very handsome stone.

Before we take up the description of the Geology of the Blue Ridge at this point, and of the Plateau region, it will be necessary to give some account of the topography of this part of the state.

Topography of the Plateau Belt.

As may be seen on most maps of the state of Virginia, the Blue Ridge up to the northeastern corner of Floyd county, is a single range. At this point it forks; one branch of the fork continues in the general direction maintained by the Blue Ridge up to that point. This is the northwestern limb. The other limb of the fork sweeps around, first to the south and then to the southwest, so as to embrace the three counties, Floyd, Carroll, and Grayson. The northwestern prong of the fork is geologically the continuation of the Blue Ridge, as Prof. Wm. B. Rogers long ago showed, and should, as he maintained, retain the name of Blue Ridge. Unfortunately, however, this ridge is known by a number of names. Thus, in the northeastern portion, it is called Pilot mountain. After the passage of Little river through it, it is for some distance known as Mack mountain; farther southwest it is called Poplar Camp mountain, and in the southwestern part of the state it is called Iron mountain.

Usually most of this ridge is composed of Primordial strata, and the Azoic rocks composing the Plateau, have their western margin close to the southeastern foot of the ridge. The Lower Silurian limestones run close to the northwestern foot. The more southerly prong of the fork above mentioned, is on some, if not all, of the maps of the state, called Alleghany mountains. Prof. Rogers called attention to the mistake made in thus naming them. Throughout the country in which this prong is found it is by the people called Blue Ridge, and by this name I will designate it in these notes. Between the two prongs lies the plateau, composed of the 3 counties mentioned above, and including a small portion of the southern part of Montgomery county, viz., the Brush Creek region.

Neither of the ridges composing the forks stand more than a few hundred feet in their higher knobs above the plateau, and the gaps in them are usually on the same level with the plateau. They are simply somewhat higher rises of a narrow plateau belt, the whole of which stands much above the level of the country on each side. Within the plateau, there are in some portions, ridges that are higher than the bordering mountains. Among these may be mentioned Will's ridge near Jacksonville, Point Lookout and Buck mountain in Grayson. Buffalo Knob in the southern corner of Floyd, about six miles from from the Blue Ridge, is the highest point in the plateau. It is only a few feet lower than the Peaks of Otter.

The Blue Ridge is the dominant range, and serves as the water shed for the principal streams of the plateau and of the country to the south. The principal streams of the plateau, after rising in, or near the Blue Ridge, find their way, by gaps in the northwestern prong of the fork, into New river. Both of the bordering ridges rise in height as they are followed southwest. The northwestern ridge, now called Iron mountain, in the vicinity of White Top mountain, diverges somewhat from the margin of the Azoic rocks, and leaves an interval of several miles that is occupied by the lowest strata of the Primordial This Iron Mountain range is continued into Tennessee as the Chilhowe mountains. Balsam mountain, White Top, &c., in Grayson, are composed of Huronian strata; White Top shows a good deal of chlorite schist and metamorphic felsite. Balsam and White Top form a diverging range that continues into North Carolina as the Unaka, or Smoky mountain range. The felsite of White Top is highly quartzose, and by its durability seems to have aided in maintaining the great height of that mountain.

The Blue Ridge lying on the southeast side of the plateau, rises and expands as it goes southwest, sending off spurs into the Piedmont country of Franklin and Patrick counties. It forms a broad swell of land containing several ridges. All these are comparatively gently undulating in contour. The easy decay of the component strata has prevented the formation of precipitous slopes, and gives to many of the ridges wide and nearly level tops. This topography, combined with the deep light soil formed out of the hornblendic mica schists, greatly favors the agricultural character of the region.

Near the border line of Floyd and Carroll, the water shed is some miles within this belt of elevated land. The character of the principal head streams of the Dan river well discloses the topographical features of this portion of the mountain belt. The Dan rises several miles within the mountain belt whose southeastern escarpment forms the well-defined mountain range that overlooks the counties of Franklin and Patrick. It flows for some distance in this belt through a region that is so nearly level, that it is called the "Meadows of Dan." Issuing from these meadows the stream flows over the escarpment by a series of rapids and waterfalls, and finally enters into the Piedmont district of Patrick.

The Floyd plateau stands about 1300 feet above the Piedmont country to the southeast. The descent in a southeasterly direction is rapid, so that the edge of the plateau stands up as a mountain wall. This is called the Blue Ridge as was before stated. The height of this, as seen from Franklin county, contrasts very strongly with the elevation as seen from within the plateau. From within the plateau the Blue Ridge appears as an interrupted line of low ridges rising here and there into knobs several hundred feet higher than the main ridges.

(To be continued.)

The Virginias.

Serial No. 48. Vol. IV.—No. 12.

Staunton, Va., December, 1883.

Jed. Hotchkiss, - Editor and Proprietor.

Table of Contents.

The Virginias for 1884.—This number completes the 4th volume and year of *The Virginias*. We will be obliged to our subscribers if they will at once renew for 1884 by sending us Two Dollars. The paper will not be sent to any one that does not pay for it in advance, and for the year, as all subscriptions to it begin and end with the year.

Arrangements have been completed for the introduction of several new and important features in *The Virginias* for 1884 by which its value will be greatly increased.—We hope our friends will invite others to join them in subscribing for 1884.

A Free Railway law is now one of the greatest and most important of the wants of Virginia, such a law as is now in operation in West Virginia, Pennsylvania, and in fact nearly all the states of the Union, especially those that have mineral and timber wealth to develop. Our present law for incorporating railways is a bar to progress, for no charter can be obtained for a railway company except from the legislature which meets but once in two years, and by the tedious and very often expensive and always uncertain routine of legislation by special bills. The present legislature owes it to the people, now that the development of our mineral wealth is well assured, to pass a simple, general railway law, such an one as has been found to work well in other states, under which a company can be incorporated at any time, to build a railway anywhere in the state, by simply filing with the Secretary of the Commonwealth a charter drawn in compliance with the forms of the law and paying a moderate fee for a certificate stating that such forms have been complied with and declaring the company so applying incorporated. Such a law should be passed at once, to cut off the deluge of railway and other company incorporation bills that has already set in on a flood-tide.

The last legislature *passed* one hundred and eight acts of incorporation that became laws; it considered probably twice as many more, so that it is fair to assume that more than half of the time of the session was taken up with business that could all have been better provided for by a general law that could have been passed in one week. The present system is a disgrace to the state. Under it has grown up the business of jobing in railway charters, the buying and selling of "Acts of incorporation," to the manifest detriment of the Commonwealth in numerous ways that will readily suggest themselves to any reflecting observer of events.—We hope that some member of the legislature will at once introduee a bill for a free railroad law.

A new census of Virginia, to be taken in the year 1885, should be provided for by the present General Assembly and a Superintendent thereof be appointed that he may have time to select supervisors and enumerators and make preparation for a full and complete report upon the actual condition of the population, industries, and resources of the state. Provision could be made that the superintendent should not enter upon his duties before June 1st, 1884, giving him one year—a period short enough as any one familiar with such a work knows—in which to make preparation for a census to be taken as of June 1st, 1885.—The following quotation of Section 22 from the Act of Congress, providing for taking the Tenth and subsequent censuses of the United States, shows that the General Government will pay half the expense of taking this census:

Section 22 of Census act reads:—"If any state or territory, through its duly appointed officers or agents, shall, during the two months begining on the first Monday of June of the year which is the mean between the decennial censuses of the United States is by this act directed to be taken, take and complete a census in all respects according to the schedules and forms of enumeration in the census of the United States and shall deposit with the Secretary of the Interior, on or before the first of September following, a full and authentic copy of all schedules returned and reports made by the officers and agents charged with such enumeration, the Secretary of the Treasury shall, upon receiving a certificate from the Secretary of the Interior, that such schedules and reports have been duly deposited, pay, on the requisition of the Governor of such state or territory, out of any funds in the Treasury not otherwise appropriated, a sum equal to 50 per centum of the amount which was paid to all supervisors and actual enumerators within such state or territory at the United States census next preceding, increased by one-half of the percentage of gain in population in such state or territory between the two United States censuses next preceding: *Provided*, That the blank schedules used for the purposes of the enumeration herein provided for shall be similar, in all respects of form and size of heading and ruling, to those used in the census of the United States."

The era of the present prosperity of Virginia began just about the time the census of 1880 was taken, consequently the returns of that census do not, by any means, show the condition of the Virginia of even 1881, and do not give a guide for estimating the present status of the Virginias. The writer was the Expert special agent of the U. S. Census of 1880 for obtaining the mineral statistics of Virginia and West Virginia, and knows that if the census had been taken *only one month later* the rank of this state would have been several places higher in the mining of iron ore and the manufacture of iron than it appears in that census.—We are satisfied that a census of 1885, taken as provided for in the law above quoted, will be of very great advantage to the state, and will greatly help, by its authoritative statements, the development of our resources and industries. We invite the attention of all the newspapers of the state to this matter and ask them to aid in securing action upon it by the legislature.

Dora Coal-field:—A Correction.—It now appears that we were in error, on page 178 of our November number, when we made Mr. Charles A. Ashburner, Geologist in charge of Pa. anthracite surveys, responsible for the statements concerning Dora anthracite coal that we quoted from "Mineral Resources of the U.S. by Albert Williams, jr.," as the following letter from Mr. Ashburner explains. The "foot note" to which he refers is very obscurely placed and the matter of the chapter, which is boldly headed "Anthracite" etc., by Charles A. Ashburner, continues as before after this foot note, which appears to the cursory reader as forming part of a table. We regret to have been thus misled, as we are sure any person would be in a general examination of the volume in question. Mr. Ashburner could not have been more surprised than we were, for we have great respect for his geological knowledge and sagacity, and we gladly give place to his correction of our statement.

Mr. Ashburner writes us: "I have just received the November number of your paper, and am *much surprised* to find that you have connected my name with the reference which is made to the Dora Coal-field in the report on the "Mineral Resources of the U. S." recently published by the U. S. Geol. Survey. If you will refer to page 24 of this report you will find the following foot note: 'Mr Ashburner's contributions and statistics end here.' All the facts I contributed to this report are contained on pages 7 to 24, inclusive, and do not even embrace all that relate to the Pa. anthracite region.

Although I have never examined the Dora coal field in Virginia, yet from information which has come to me, I have always regarded the occurence of anthracite coal there, in quality and quantity sufficient to insure successful and profitable mining, very questionable."

Mr. Ashburner's denial puts, we suppose, the responsibility for the statement we criticised on Mr. F. E. Saward, of the Coal Trade Journal, for the "Acknowledgments" of the volume state that he and Mr. Ashburner contributed the papers on coal.

The Trade reports of "Coal Trade Journal" of New York are always well prepared and interesting, but there are some things in them that from our stand-point are, to say the least, somewhat remarkable. For example, in its Chicago report a "West Virginia coke" is always quoted at a less rate than "Connellsville coke." Please inform us what West Virginia coke it is that is thus quoted. We have a good many kinds of West Virginia cokes now, and will soon have more, some of them better than Connellsville and some by no means as good, so when W. Va. coke is quoted, it would interest a goodly number of people to know which one is refered to.—We also note that this Chicago report finds no room for "Winifrede" coal, among the 16 bituminous coals that it quotes, although the Chicago trade journals do.

A Diamond found at Manchester, Chesterfield county, opposite Richmond, Va, weighed after it was cut over 10 karats. Mr. John H. Tyler, sr., of Richmond, writes: "It was found by a laborer engaged in grading one of the streets. It was brought to me to ascertain its value and character. I pronounced it at once a valuable diamond, and recommended the finder to keep it carefully and see me again about it. I did not know his name and have not seen him since. The next I heard of the stone it was on exhibition at Ball, Black & Co's. store, in New York, and that it had been sold by the finder to some one in New York for $1,800, though I could have got for him $5,000 for it. I understand that it was sent to Germany to be cut. It was an octohedron, and had only one small black spot near one of the points, thus enabling it to be cut to great advantage.—*Williams' Min. Resources of U. S.*

Coal and Coke Traffic of Ches. & Ohio Ry., Nov., 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during Nov., 1883, and Nov., 1882, in tons of 2,000 lbs., compiled by fuel agent, C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	318	2,919	....	2,601
Gas	28,213	29,157	....	944
Splint and block	8,434	9,369	....	935
New River, &c	38,107	28,487	9,620	.....
Coke	7,428	7,711	....	283
Totals	82,500	77,643	9,620	4,763

This movement for November, 1883, shows a net increase of 4,857 tons compared with the movement for November, 1882. This showing is a decided improvement on that for October, when there was a net decrease of 3,302 tons.

The distribution of the above was as follows:

	1883.	1882.
1. To Ches. & Ohio Co. for its own use	20,084	16,173
2. To Huntington, for West via Ohio river	1,510	....
3. On Elizabethtown, Lexington & Big Sandy RR.	3,786	5,060
4. On Ches. & Ohio Ry., excepting Richmond.	15.551	11,341
5 To Richmond & Alleghany RR. at Clifton Forge.	1,672	1,877
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	63
7. To Shenandoah Valley RR. at Waynesboro	85	3,812
8. To Va. Midland Ry. at Charlottesville	6,405	6,405
9. To Richmond, Fredericksb'g & Potomac RR. Junc.	702	633
10. To Richmond for consumption including tugs, &c	10,097	9,968
11. To James River wharves for shipment	.....	9,559
12 To Newport News { Consump'n includ'g tugs &c,	767	129
12 To Newport News { For shipment	21,841	12,623
Totals	82,500	77,643

The noticeable features of this distribution are the continued increasing deliveries on the line of the railway west of Richmond, in consequence, largely, of the demands of blast furnaces, and the large increase in shipments at Newport News.

The total movement from January 1st to November 30th, for the years 1883 and 1882, was as follows:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	20,941	29,260	.....	8,319
Gas	331,502	310,206	21,296	.....
Splint and block	84,520	115,933	.....	21,413
New River, &c	369,497	328,718	40 779	.....
Coke	94.285	83,847	10,438	.....
Totals	910,745	867,964	72,513	29.732

The above shows a net increase of 42,781 tons, or about 5 per cent, in the total movement of 1883, as compared with 1882, up to November 30th. The large gain in movement of New River coals, over 40,000 tons, shows how rapidly the superior steam coals of that region are growing in favor. Newport News with these coals to supply is steadily coming to the front as a coaling station.

Rockbridge tin mines.—The latest information from the tin deposits of the Blue Ridge, Rockbridge county, Va., is that they are being prospected by Professors Silliman and Goodyear, of Yale college.

Sunstone of very good quality, almost equal to the Norwegian, is found at "Orange county Court-house, Amelia county, Va.," says Williams' Mineral Resources of U. S. A quite uncertain localization, we would suggest, as Orange C. H. is, of necessity, in Orange county.

Norfolk & Western RR.—The board of directors of the Norfolk & Western Railroad Company held an important meeting at Alexandria, Va., Nov. 28th, 1883. The company has had under consideration for some time past the importance of building warehouses, coal piers, &c. upon the property controled by them at Lambert Point, Norfolk; also extending their New River division to open up new coal mines, and the building of branch lines into the important mineral districts adjacent to its line. The question of making financial provision to enable the company to undertake these important works, having been refered to a special committee, the meeting held to-day was for the purpose of receiving their report.

The committee submited a statement in which they called attention to the fact that in the past three years the gross earnings from the traffic of the line had increased over forty per cent, largely due to the policy adopted by the company in building up its local industries, and stated that, although more than two millions of dollars had been expended during that period for betterments and improvements upon its line, in addition to the amount provided for by the sale of its mortgage bonds, the traffic has so largely increased that the present facilities are insufficient.

The committee reported that, taking into consideration the valuable results that have been secured by former extensions, they considered it important that a comprehensive policy should be adopted, by which financial provision should be made for the immediate requirements, and such further extensions and improvements, as may from time to time be requisite.

In order to secure the necessary means, the committee recommend that the company issue $2,500,000 improvement and extension bonds secured by a mortgage upon the property, and submited a proposition to the company from a syndicate of bankers, headed by Messrs. Drexel & Co., and E. W. Clark & Co., of Philadelphia, for the purchase of the bonds on terms which they recommended should be accepted. The board unanimously concured in the report recommended by the committee, the sale of the bonds was confirmed, and the president was authorized to undertake the work of construction and improvement.

By this action the Norfolk & Western RR. Co. will undoubtedly be enabled to make very important additions to its earning capacity.

We learn that the new mortgage will be, for $5,000,000, but that not more than the $2,500,000 above refered to will be issued at the present time; and no further issue will be made except for the purposes of extensions and improvements, and only when so authorized by the vote of the stockholders, the present issue of $2,500,000 supplying adequate means to prosecute to completion all the improvements that are at present contemplated.

The present funded debt of the Norfolk & Western RR. Co. is but $25,400 per mile, and the proposed issue of bonds, taking into consideration the increased mileage due to the proposed extensions will make the total funded debt $27,380 per mile, a remarkably small funded indebtedness for so important a line.

Every one interested in the development of the Virginias, will be gratified at the success of the Norfolk & Western in securing this large sum of money at this time when it can use it to such great advantage, both to itself and to these states; first in the construction of a branch railway from its main line, at or near Martin station, southward and westward into the great iron ore region of upper New river and Cripple creek, where, with this branch road completed, giving access to Flat-top coking coals, there are exceptionably favorable locations rendered available for the cheap manufacture of high grades of pig iron; and second, in the extension of a branch road down Bluestone river, from the vicinity of Pocahontas, along the front of the Flat-top coal lands of the Bluestone-Flat-top Coal Co., so that company can at once enter upon the work of opening mines in the "big coal bed" of the Flat-top series and engage in the construction of coke ovens to aid in supplying the large demand for the superior New River coke, that will be made from these coals, when the large furnaces that are at once to be erected on Cripple creek are completed.—This also means more. When, by the aid of this cash-in-hand power, the Norfolk & Western shall have fairly penetrated the great Flat-top coal fields, it will find itself on the "divide" from which flow the Big Sandy, the Guyandot, and the Coal rivers, where the irresistible invitations of easy down grades and direct access to the great markets of the northwest, will surely lead to an early joining of its lines with one or more of the half dozen roads now being made ready for up these natural river routes from the Ohio.

Kentucky Petroleum.—The Richmond, Va., analytical and consulting chemist, Dr. H. Froehling, has kindly favored *The Virginias* with the results of an examination of a sample of Petroleum from a shallow well rudely sunk by Mr. Archer Harman, of Staunton, Va., on land owned by him and others, on Lollugred creek of Kentucky river, near the dividing line of Montgomery and Clark counties, Kentucky, a few miles southeast from Winchester and within a short distance of the new Kentucky Union Ry.—Sufficient pumping has been done to prove that a large body of superior oil has been taped, and now that its character and adaptations have been determined it will be thoroughly prospected.

Dr. Froehling reports of this oil as follows:

"The sample of petroleum as received, contained considerable water and suspended impurities. After careful separation to oil it was found to have:

Specific gravity	21°.2 Baume.
Flashing point	292° Fahr.
Fire test	318° Fahr.
Cold test—limpid at	−5° Fahr.
Reaction	neutral.

This oil has an extraordinary specific gravity, 21°.2 B., and a remarkable cold test, viz: limpid at −5° Fahr. This cold test confirms the statement made that the sample sent had not been exposed to spontaneous evaporation.

The specific gravity and fire test of this oil preclude its being employed in the manufacture of burning oil; in fact it is too valuable as a lubricant to be used for illuminating purposes, even if it were possible to so use it.

From my experiments, on one of Prof. Thurston's lubricator testing machines, I conclude that this oil is especially suited for a *lubricant for very heavy, slow-moving machinery*, such, for instance, as is used at the Richmond city water-works. I also believe, that it would make an excelent cylinder oil, especially if filtered. They are now using at the Richmond city water-works sperm and castor oils as lubricants, but I believe this oil could take the place of these expensive oils."

We are informed that our young townsman has been offered a very handsome sum for this oil property by the Standard Oil Company; but he and his assistants have wisely decided to have it fully tested and its value ascertained before parting with it. The Editor will visit this property, professionally, in a few days.

Notes on the Geology and Mineral Resources of the Floyd, Va., Plateau.

By Prof. Wm. M. Fontaine.

(Continued from page 180.)

The relations of the plateau to the Limestone Valley on the northwest are similar, but the limestone belt formed of Lower Silurian strata is a good deal higher than the Azoic Piedmont country. The plateau stands on this side above the general level of the limestone from 500 to 700 feet, while the higher portions of Pilot and the other parts of the bordering mountains may rise 300 to 500 feet higher. There is nothing in the durability or geological structure of the rocks composing the plateau that will explain why the mass of the plateau stands above the surrounding country. This entire mass, extending from one bounding ridge to the other, must have been elevated by pressure, such as squeezes up single ridges.

After this account of the topographical character of the country, we may turn to consider the geological features of the country in question.

The Blue Ridge in Franklin County.

The southeastern foot of the Blue Ridge, over a belt about 4 miles wide, is composed of strata essentially the same as those lying between Rocky Mount and this foot. In this band, however, there is more of the rocks having the character of hydromica slate and schist. These are steel gray, or bluish gray in color, very fine grained, with a glistening lustre. As is generally the case with this class of rocks in Virginia, the amount of quartz found is large. This occurs in many forms. It is found as nests, pockets, small lumps and in regular veins. This kind of rock also, very generally, contains pyrite, either diffused in the schist or found in the quartz. Between Mr. Saunders' place and the foot of the mountain, several quartz veins were seen that, so far as the presence of pyrite and other features may have meaning, look much like auriferous veins. The most promising of these occur about one mile west of Muse's store. They seem to be true fissure veins, are much stained with oxide of iron, and present many cavities left by the oxidation of pyrite. These bluish gray hydromica schists are worthy of especial attention. So far as I have observed in Virginia, these rocks, with the associated and closely allied fine-grained mica schists, are beyond all others the bearers of valuable minerals, such as the ores of copper, lead, etc., and the auriferous quartz veins.

At the foot of the Blue Ridge, where the principal ascent begins, there is a dike of eruptive rock about 40 feet wide. It appears to be Diorite Its presence is favorable for the occurence of the valuable metalic minerals. Succeeding this dike for some distance in ascending, we pass over rather heavy beded hornblende schist ,with some metamorphic Diorite. Possibly these strata may be the cause that maintains the steepness of the escarpment of the Blue Ridge. I have observed that similar strata are very commonly found on the eastern portion of the Blue Ridge in the middle counties of the state. Higher up the mountain we find fine grained mica schists, graduating into mica slates. These have more of the Montalban look, but cannot be separated from the rest of the strata along here which possess the Huronian characteristics. These beds are much warped in strike, and show in dip many minor flexures. After these come more coarsely crystaline and highly micaceous mica schists, they form a wide belt, and if we admit the independence of the Montalban group, may belong to that series. Next come hornblende schists that look as if they are a repetition of those found further down the mountain. They contain a good deal of the mica, Biotite, and are associated with some mica schists that contain a good deal of same mica. These strata are much contorted and deeply decayed. They are similar to the strata exposed on James river just above Lynchburg.

Next to these strata in ascending, we find a great body of the bluish gray, hydromica schists and slates. They extend to the top of the mountain and for some distance into the plateau. They graduate frequently into fine grained mica schists that carry more or less fine hornblende particles. These hydromica schists may always easily be distinguished from the more coarsely crystaline mica schists, but it is impossible to say what their stratigraphical relations are. It is probable that the hydromica rocks are younger than the mica schists, hornblende schists, &c., but they still form part of the Azoic strata. They show the following general features. They contain an abundance of quartz as before mentioned. They are much contorted, the disturbances showing themselves both in large flexures, and in minute wrinkles and bendings, that appear in hand specimens. The color is lead, steel, or bluish gray, the lustre high, the texture non-crystaline, at least no crystaline particles are shown to the unassisted eye. There can be no doubt that they are older than the oldest Primordial beds, for I have seen, in Albemarle county, the oldest Primordial beds resting on the hydromica schists and containing abundant fragments from them.

Copper Deposits of the Plateau Belt.

The discovery of the Ducktown copper deposits led to active search through the plateau counties for copper ores, and the search was greatly stimulated by the fact that the geological character of the two districts is much alike. Indications of copper were found in many places and great deposits of "Gossan" discovered. The excitement attending the search for copper seems to have been at its height about 1857–8. Openings were made at many localities and mining operations undertaken in search of Black copper. No other ore seems to have been regarded Extravagant expectations were aroused. All bands and ledges of rock that showed traces of copper were dignified with the title of "lodes." Of course, under these circumstances, much disappointment was caused in a good many cases, for those extravagant expectations were not justified by the facts. Still, up to the begining of the late war, the copper of this district was being developed, as it is said, with success at several points. The coming on of the war put a stop to all operations, and since that time they have not been resumed.

From this condition of things it is very difficult to form any accurate idea of the true character of these deposits of copper in most cases. Nearly all of the old workings are now inaccessible from having caved in, or from being filled with water. In most cases I was compeled to form my conclusions from the inspection of the material on the dumps, or from a very incomplete inspection of the ruined works. As copper sulphurets are prone to oxidation if left exposed, and as the copper is readily removed in solution by the natural waters, it will be easily seen that I examined these deposits under circumstances that would not permit, perhaps, full justice to be done them.

In the number of *The Virginias* for July, 1882, I gave some account of the gold and other minerals in the Brush Creek region, which lies in the portion of the plateau found in Montgomery county. In the number of the same journal for October, 1882, I gave a brief account of the deposits of sulphurets in the plateau region. I must refer the reader to these papers, as they will enable me to abridge my account of the mineral deposits of the region now in question. I will notice the mineral deposits nearly in the same order in which I visited them.

Howell Copper Mine.

This deposit was partially described in the number of *The Virginias* for Oct. 1882. I will add a few statements to what was there said. The deposit occurs in the extreme western edge of Franklin county near the top of the Blue Ridge. It is essentially a band of hydromica schist impregnated with Pyrrhotite, which carries a little copper here and there. The workings are all filled up and I could not see the precise character of the deposit. A good deal of gossan marks the outcrop of the impregnated ledge, and the dump contains some large lumps of Pyrrhotite. I could see no copper in them. I was, however, informed by Mr. Huff, who had seen the deposit when it was being worked, that besides the occasional dispersed lumps of yellow copper, a thin seam of that ore existed. This was one inch wide, but thickened sometimes, and even reached the dimensions of 12 inches in one place for a very short distance. The enclosing strata dip here more flatly than usual, the dip amounting only to 35° to the S. S. E. The strike is about the normal one of 50° to E. of N. The mine was worked by open cuts and a shaft. It was begun in 1854.

About the year 1820, it is said, Col. Lewis attempted to use the gossan of this deposit as an iron ore, in his furnace on Little river, but, as it is said, found that it contained too much copper to make iron capable of welding. The castings made from it, however, are said to have been excelent. How far this may be true I cannot say, but I am inclined to think that it is simply a tradition applied to all the gossan outcrops. I found the same story, with change of persons, current concerning the Toncray deposit, and also the deposits south of Hillsville, in Carroll county. I could not learn that any copper ore had ever been shiped from this locality. So far as the geological occurence of this deposit is concerned, it may be taken as a type of most of the copper deposits of the plateau. The copper ore, that is the original ore, is Chalcopyrite in all these deposits, and it is interesting to note the constant association of Pyrrhotite with it.

The deposit of Pyrrhotite with copper at the Howell mine, seems to belong to a band of strata that lies on the southeastern side of the plateau, near the Blue Ridge which at intervals shows deposits of these sulphurets. Farther southwest we find them appearing at and near the Toncray mine. The sulphurets of iron are often in great quantity and do not always carry any noteworthy amount of copper. The sulphurets on this side of the plateau, do not form such connected and continuous ledges, as we find in Carroll county more towards the middle of the plateau. In many places where no deposit has been developed by openings, the bluish gray hydromica schists, and the fine grained mica schists, show by their decaying in irregular corroded forms, by the smell of sulphur, by the efflorescence of copperas, or the occasional presence of mineral springs, that the sulphurets are at least diffused in the rocks.

From Dug Spur Gap to Jacksonville.

Jacksonville is the name of the county seat of Floyd. The county road leading from Dug Spur gap to this point, has a course quite oblique to the general trend or strike of the strata. The same strata are better exposed along the road leading from Patrick county, through Maybury gap to Jacksonville. Maybury gap is improperly made on the state map, "Mowbray's gap." I examined the strata along this road, and those shown along the road from Jacksonville to Pilot P. O., on Brush creek, which is a continuation to the northwest of the same line of section. This route passes nearly at right angles to the strike of the strata and gives perhaps the best exhibition of all the strata of the plateau that can be obtained. Although the rocks change somewhat as we go southwest in the plateau, we may, I think, consider the rocks shown along the route first mentioned as fair types of those found everywhere in this region. I will for this reason give a very brief account of them.

Approximate Section from Maybury Gap to Pilot.

The strata along this line of section are very variable, and the different kinds pass into one another so constantly and gradually that, so far as I could see, no separation of them into distinct geological formations can be made. They can only be separated by their lithological character. Even this feature fails if we attempt to use it in detail. The same stratum, followed on the strike, as it appears, changes its lithological character. When crossed at right angles to the strike, we may, it is true, recognize decided differences in the lithology of certain wide bands taken as a whole, but any one of these contains frequent intercalations of the rocks that characterize as a whole some other band The dip is constant to the so utheast, and in most cases the changes in its amount are due to the greater or less warping that the strata have locally undergone, or to the minor local flexures, caused by the greater or less ease with which the strata have yielded to the flexing force. The entire mass of strata composing the plateau must, I think, be regarded as disposed in a series of closed anticlinals and synclinals that have been overturned to the northwest, and have suffered greatly from erosion. This mode of flexing has brought repeatedly to the surface the same beds. We may, I think, trace a decided increase in the metamorphism in going southwest along the plateau. The mica schists have the scales of mica larger, the quartz tends to aggregate into larger particles. The hornblende becomes better crystalized and more abundant, so that hornblendic mica schists tend to pass into hornblende schists. The increasing coarseness of the crystaline particles and their better individualization causes the hydromica schists of the northern portions to pass into fine grained mica schists in the more southern portions of the belt.

If we compare the rocks of the plateau, taken as whole, with those of apparently similar age in the northern part of the state, we may trace similar changes. These strata are Huronian in their general facies, but they show some important differences from the Huronian of the more northern counties of the state. The chloritic, epidotic, and felsitic schists, that form such an important and conspicuous feature farther north, are almost entirely wanting in the plateau belt. None of them were seen in the line of section now in question, except in the immediate vicinity of Pilot mountain, and here they were rare and insignificant in amount. It is true, however, that they appear in force in the extreme southwestern edge of the plateau in Balsam and White Top mountains. The only representive of these rocks in this section seems to be the bluish gray, glistening, hydromica slates and schists.

I will begin the section with the strata of the southeastern foot of the Blue ridge, on Rock Castle creek. There must be, in this vicinity, some small outcrop of the typical chlorite slates and schists of the Huronian, for fragments of a rock were brought to me from this vicinity that had this character, and contained imbeded well formed crystals of magnetite. If present, however, the amount must be small.

At the southeastern foot of the Blue Ridge, on the main road, the strata are fine grained, flagy, hornblendic mica schists, striking about 50° E. of N. The amount of hornblende and mica varies; sometimes one and sometimes the other predominates. The southern slopes of the Blue Ridge on the road show fine grained to compact, bluish gray, or grayish, hydromica schists and slates. They often contain diffused pyrite, and are much wrinkled and contorted. Bands of hornblendic mica schist occur in this system of beds. These strata have a variable dip and strike in the

usual direction. Towards the top of the mountain the amount of hornblendic mica schist becomes greater, but the beds are still very fine grained and slaty or flagy. The dip up to this point is usually pretty high, being on an average as much as 50° to the S. E. Here, near the top of the mountain, the usual strike of 50° E. of N. becomes 35° E. of N.

Next in order, proceeding from the top of the mountain into the plateau, we have with the same strike, a wide belt of the bluish gray hydromica schist and slate. This sometimes becomes somewhat chloritic, but not so much so as the typical Huronian chloritic strata. All the strata up to this point must, from the lithology, be considered as Huronian, but these hydromica schists have the Huronian facies most strongly shown. In this band of rocks we find a belt about one mile wide, that is noteworthy for the large amount of quartz that it contains. In place this quartz occurs in veins, nests, lumps, &c. The decay of the enclosing strata has allowed the quartz to accumulate on the surface to the serious detriment of the agricultural character of the soil. This highly quartzose band is a conspicuous feature in the plateau, and may be traced for a long distance northeast and southwest with the general strike of the rocks. The hydromica schists that lie on both sides of this belt, are those that so often contain diffused pyrite. The next band of rocks, with a somewhat distinct lithological character, to the northwest of the hydromica schists, is one of the so-called soapstone belts. It is exactly like that described at Rocky Mount It is a soft rock composed mainly of mica irregularly felted together, with fine quartz diffused in the mica in the state of flour; sometimes a little chlorite and hornblende are present. The visible width of the belt is about 300 yards. The width, however, varies very much. Next to the northwest of this we have a wide belt of a well defined and rather coarse-grained mica schist. This rock has the features of the Montalban group. The dip is 60° to the S. E., and the strike 55° E. of N. The belt is over a mile wide. This belt of strata also is conspicuous in the plateau. It may be traced throughout the two counties visited by me. This is the coarsest and best crystalized rock that occurs in the central portions of the plateau. It becomes coarser and better crystalized as we go southwest. Near Hillsville it has a little feldspar sometimes, and then makes an approach to gneiss in character. It has been used at Hillsville for building the court house, and is called there granite It makes a handsome building stone as found near Hillsville. This rock is the nearest approach to granite and gneiss that I saw in the central and southeastern portions of the plateau, and it may be the rock called granite by some writers on the geology of this region The material is gray in color, and in some parts is quite fissile. This belt appears farther southwest in Grayson county to rise higher, and it may there be associated with gneiss.

From the position of Point Lookout mountain, and Buck mountain, in Grayson county, and the direction assumed by the mica schist belt now in question, as it passes through Carroll, I think that the massive mountains above mentioned are composed of this rock. I did not visit these mountains, and cannot speak positively about them. I was informed, however, by intelligent and observant persons, that the rock composing these mountains is the same in nature with that of which Carroll C. H. is built.

If this series of mica schists must, in virtue of its lithological character, be made a distinct formation, I think that it is older than the associated strata of the Huronian type. I saw nothing that could serve as a basis of separation, if we except the lithological difference, and the small difference in the amount of dip and variation in strike. This belt of mica schist contains the quartz vein with pyrite, chalcopyrite, and galena, found near Jacksonville, and which will be described later.

From Jacksonville, the county seat of of Floyd, northwest to the vicinity of Pilot mountain, we have essentially the same kinds of rocks as those that have been described up to that point. They are retained at the surface, as has been said, by a series of closed folds which cause numerous repetitions of the same beds. To the northwest of Jacksonville the mica schists and mica slates predominate, and the hydromica schists are less in amount than towards Maybury gap. Hornblendic mica schists and hornblende schists are common.

Proceeding on the Christiansburg road the following facts were noted. The exposures are poor, and the observations made were not complete. The next belt of rock to the mica schist last described, is a flagy hornblende schist, that is sometimes almost fine grained enough to form a sort of slate, since it splits often smoothly, giving thin flags. Excelent flaging could be obtained from it in some localities, as on the road from Jacksonville to Hillsville, and 2 miles southwest of Jacksonville. Here it is extensively displayed along the road. It forms a band of about the same width as the mica schist band, and the two kinds of rocks often graduate into each other. Both must be considered as belonging to the same formation. The dip, as seen on the road above mentioned, is much lower than that of the mica schist. It amounts to only 30°, and is to the southeast. This may be local, however.

Next in order, going northwest, we have fine grained mica schists and micaceous slates, with some slaty hornblende schists. These rocks are succeeded by a wide belt of the hydromica schists before described. All of these last mentioned rocks belong together, and are intimately connected by gradual passages into one another. This is apparently a repetition of the band described as existing southeast of Jacksonville. Next comes another wide band of the fine mica schists and micaceous slates. This seems to be a repetition of that just mentioned. The strike is N. 45° E., and the dip 50° to the S. E. This rock contains a great deal of quartz, occuring as it does in the hydromica schists. Some of it looks as if it were auriferous, as it is much stained with limonite, contains pyrite, and is cellular. This belt is over one mile wide. The bluish gray hydromica schists come again on the northwest side of this belt and expose a wide band.

This brings us to Little river, beyond which the mica schist comes in again. All of this mica schist from Jacksonville to this point is very fine grained, and it is only a more crystaline member of the same group with the hydromica schist which usually shows no crystaline grain. In the last mentioned mica schist, however, the crystalization is sometimes more distinct, and in places rounded, imperfectly formed granules of feldspar and quartz occur, forming bands of the rock called hy Prof. Wm.B. Rogers "Gneissoid sandstone." This is simply a variety of the mica schist in which the constituent particles are better individualized than in the normal fine grained variety, and in which some feldspar appears. It is noteworthy that the quartz, which in the fine grained variety, is diffused in the state of a fine flour, now is often aggregated into amygdaloidal granules. The feldspar takes this form also, and in weathered specimens the rock would be taken to be a conglomerate. The strata in this portion of the plateau are much like those around Charlottesville. The dip here is 45° to the S. E., and the strike 45° E. of N.

After passing over this belt, the hydromica schist again appears on the northwest side in a wide band. Here also a great deal of quartz occurs in the usual forms. This band forms the broad-toped water shed that bounds the valley of Laurel creek on the southeast. On the northwestern and northern slopes of this water-shed, and in the valley of Laurel creek, the fine grained mica schists appear again, showing a

great deal of quartz. Gold has been found in the sand and gravel of this stream, and it no doubt comes from the quartz in this mica schist.

We see then that from the southeast foot of the Blue Ridge, at Rock Castle creek, on the Maybury Gap road, with one possible exception, we have had for 15 miles repetitions of the same kinds of rocks, viz: Fine grained mica schists and slates, associated with with hydromica schists, and carrying more or less of hornblendic rocks. The possible exception is the band of well crystalized mica schist and hornblende schists, occuring near Jacksonville, and occupying a somewhat central position in the plateau belt. This coaser mica schist is apparently much freer of quartz than that which is intimately associated with the hydromica schist.

The mica schist in the valley of Laurel creek extends some distance up the southeast side of Laurel ridge. This is the ridge that bounds the valley of Brush creek on the southeast side and runs parallel with Pilot mountain. On the Christiansburg road, the upper part of this ridge is composed of the lowest portion of the Primordial formation. It is a mere remnant of the Primordial left uneroded, and forms the most southeasterly extension of the Primordial that I saw in the plateau. It is a noteworthy fact, that the lower members of the Primordial always form those portions of that formation, that are found farthest within the Azoic area. They are usually more metamorphosed than the higher members.

The rocks of the Primordial in Laurel ridge are brownish conglomeratic sandstones, with numerous interbeded layers of fine grained gray, bluish or redish gray shales. Towards the upper part of the group, the shale makes up most of the mass. Numerous seams and pockets of quartz occur in the shales, which often contain pyrite. Perhaps these quartz veins are in part the source of the gold found in the surface material on and near this ridge The strike of the strata is N. 44° E., and the dip 45° to the S. E. These strata extend some distance down the northwest face of the ridge, and are succeeded by the Azoic rocks that carry the gold of Brush creek.

The strata exposed along Brush creek are hydromica slates and schists of Huronian type, but they contain many bands of imperfectly crystalized gneiss, varying from a few feet in width to 100 feet or more. These strata have been partially described in my paper in *The Virginias* for July, 1882, on the "Brush Creek Gold Deposits," and I would refer the reader to that paper. The strata composing the northwest foot of Laurel ridge with the valley of Brush creek, and extending about ½ of a mile farther northwest, are of the nature above mentioned. The gneiss bands, though least in amount, are of most importance, as they carry the quartz veins with gold on Brush creek, and the gneiss itself sometimes contains free gold. This gneiss is simply the product of more thorough metamorphism acting in certain bands of the hydromica schist, and in it the original hydromica base may often be seen mingled with the imperfectly crystalized particles of quartz and feldspar, developed in the hydromica schist as the starting point. This gneiss, I am convinced, is the source of most of the alluvial gold of Brush creek, which came, I think, mainly, not from the quartz veins, but from diffusion in the gneiss itself. Particles of gold are sometimes visible in it, and the small bits of waxy looking quartz sometimes found sticking to the larger grains of alluvial gold, did not come from the quartz veins but from the gneiss.

The strata lying to the northwest of the group just described are best exposed on the head-waters of the south fork of the Roanoke river, and on the Locust Grove road. This road passes about six miles to the northeast of the locality worked for gold at Walter's place, on Brush creek. I will give a brief account of the strata seen on this road.

The Brush creek gold-bearing strata pass on the northwest into mica schist of fine grain, giving again the usual association of this rock with the hydromica schist. This rock is very easy to break down and decay, and its friability, with the ease with which it is eroded, gives a precipitous character to the hills and valleys formed out of it. The strike, like that of the system just described, is less to the east than that of the Primordial of Laurel ridge being N 35° E. The dip is higher than that of the Brush creek gold-bearing rocks, being 60° to the S. E., against 45° as found in them. The mica schist has a great deal of quartz occuring in the forms so common in other parts of the plateau in this kind of rock. In this vicinity the quartz veins are exceptionally heavy and numerous. No doubt some of these veins will prove metaliferous. On the tract of land owned by Mr. Kinnet, this mica schist is cut by a dike of eruptive rock about 4 feet wide at the point where it was seen This is the only eruptive rock that I saw on the plateau. It attracted my attention in a special manner, for I have found that all the auriferous quartz veins in Virginia occur in the hydromica schist and fine grained mica schist, where these are occasionally penetrated by eruptive dikes. This is true of the eastern gold belt runing through Louisa Buckingham, and the other counties in its line of strike. It is true of Albemarle county, in the vicinity of Faber's mill, where gold is found. The outcrop is by decomposition changed to serpentine. I believe that the presence of this eruptive rock greatly increases the probability of finding the precious metals in this section.

Although this mica schist is precisely like that seen in such abundance between Laurel ridge and Jacksonville, yet it contains an important band of granulite that I nowhere saw except here. Still it is quite possible that granulite may exist in the other mica schist bands and may not have been seen. The granulite is well exposed on the road, showing a thickness of about 300 feet. It graduates into the mica schist on each side. It is a rather fine grained, durable and handsome rock, composed of feldspar and quartz. Some of it would quarry well and make an excelent building stone.

Next to the mica schist belt on the Locust Grove road, comes a band more than a mile wide, of a coarse grained, well crystalized, porphyritic gneiss, that lies in heavy beds. It is composed almost wholly of feldspar and quartz, but contains some hornblende. It is the hornblendic gneiss of the Laurentian, and is the lowest rock of the Azoic strata. The dip is to the S. E., about 45°, and the strike is about 45° E. of N. This rock occurs well exposed at Mr. Jack Light's place, on the Lick fork of Roanoke river, where my examinations on the Locust Grove road ended. It is in this rock that the deposit of Pyrrohotite with some little copper, occurs at Jack Light's place. My examination did not extend through the Laurentian belt, and I did not in this direction go as far as Pilot mountain. I, however, made examinations from the Brush Creek valley over Pilot mountain on the Christiansburg road, and the results there supplement those obtained in the route first described. The mica schist on the Christianburg road is not so conspicuously displayed as on the Locust Grove road, and the strata here seem to be more largely represented by hydromica schist. The Laurentian gneiss seems to be mostly buried under the mica schist and hydromica schist. The last of the Azoic strata, seen in approaching Pilot mountain by the route now described, are hydromica schist with some chlorite schist interstratified with bands of the rough gneiss like those carrying gold at Walter's place. Some bands of hornblendic mica schist are also found. The strike is 35° E. of N. To these strata succeed the Primordial beds that here compose the whole of Pilot mountain. Both the Azoic and Primordial

dip S. E., but the dip of the Primordial is steeper and the strike is 60° E. of N.

Pilot mountain here and everywhere where I examined it is composed of the lower members of the Primordial, disposed in a closed synclinal, overturned to the northwest. The mountain seems to be held up, so to speak, by the massive layers of the lower quartzite, that composing the Balcony rock at the passage of James river through the Blue Ridge. The various members of the Primordial that may be distinguished in the Blue Ridge north of James river may be recognized here also. We have a lower conglomeratic group followed by bluish and grayish shales, then a massive quartzite, then redish grits and shales, &c., &c.

The lower quartzite is very thick here and very siliceous. It is at least 250 feet thick. This rock is in places very much crushed and consolidated by infiltrated veins of silica. It forms the highest points of the mountain as at Fisher View, near Alleghany Springs. The Potsdam sandstone member, more properly called quartzite, runs along the northwest foot of Pilot mountain, and is succeeded by the Silurian limestone.

In considering the relative position of the various rocks composing the Azoic, it is impossible to speak with positiveness in most cases. My opinion, however, is that the gneiss with hornblende, seen at Jack Light's place is Laurentian. The mica schists and their associated hydromica schists, I think without doubt, overlie this gneiss for they usually bury the hornblendic gneiss out of sight. The hydromica schists seem to be a higher member of the same great group with the mica schists, and with the mica schists must be placed the hornblende schists also. All, except the hornblendic gneiss, seem to be Huronian. There is no question of the possible formation of these strata by metamorphic action out of Primordial beds. All indications point to the entire independence of the two groups.

After this imperfect account of the general geology of the plateau, I will give a brief description of some mineral deposits examined.

Brush Creek Gold Deposits.

I have, in the paper before mentioned, given an account of these deposits that will give a fair idea of their nature and will not repeat it here. I wish to call attention to the gneiss that contains the auriferous quartz, and which itself carries some gold. As it seems to me this rock is worthy of careful examination, for it will probably prove, in some portions, much richer than the quartz veins that it carries, or than any test yet made of it indicates. It is a mistake to look solely to the quartz veins. In addition to the fact that the quartz particles, sometimes found attached to the larger granules of the alluvial gold, are of the waxy looking quartz of the gneiss, and not of the veins, many facts might be mentioned that point to this rock as the source of most of the wash gold.

The men in taking up earth from the bed of the little run on Walter's place, in the early washings, noticed that the yield was much richer on one of the gneiss ledges. They state that the dry digings on the hillside, yield much more richly over certain of the gneiss bands. Owing to the very imperfect developments that had been made at the time of my visit, and the insufficient means at my disposal, I could not make the examination of the surface of these ledges that I would have liked to make. I noticed, however, that the richest earth taken out came from the surface of the gneiss, and that most of this earth and gravel was composed of the partially decomposed gneiss. One band of this gneiss, that affording the openings mentioned in my paper, when crushed and washed, shows gold. Sometimes many grains may be found for a distance in width, in some places, of over 20 feet, and that, too, where no distinct quartz vein exists. I have one specimen of this gneiss that shows several points of gold, and I was told that a good many such might be found. The fact that gold occurs in such a large body of this rock, would of itself make it desirable that it should be carefully examined and tested at many points. The indications are that rich pockets might be found. At the time of my visit, June, 1882, very slight examination had been made of this rock. The tests made of its gold content, in the laboratory of the University of Va., are not to be taken as fairly indicating the possible value of this rock. For these tests and results, see my paper above mentioned.

The quartz veins and pockets, both of Walter's place and its immediate surroundings, as well as of the mica schist and hydromica schist region, for a large area of country around, merit a careful examination. I do not consider that, as yet, they have been sufficiently tested to pronounce a decided opinion on their value. The results given in my paper, as obtained by Mr. Page and others, indicate that the gold is irregularly distributed. I do not think that the specimens of auriferous quartz obtained by me from Walter's place, and tested at the University, for the reasons given in my paper, should be considered as fairly showing the gold content of that vein. Many of the quartz deposits and veins of that region show all the outward indications of being auriferous. They contain much diffused pyrite, and are often honey-combed, and contain much oxide of iron. They occur, too, in rocks that are often elsewhere auriferous, while there is at least one well defined dike of eruptive rock in that section. These pyritous quartz veins are too numerous to mention in detail. In addition to those described in my formerly published paper, I would call attention to one found by Mr. Walter in his bottom land, near Brush creek. This is a very strong vein, 3 or 4 feet wide, and highly charged with pyrite. No test has been made of it, but it looks very much like an auriferous vein. The bottom lands along Brush creek all, so far as examined, show gold. Capt. Hart made a large number of test holes over a very considerable area, and a number of points of gold were found in every pan of earth. The richness was amply sufficient, as it was reported, to justify working the earth on a large scale. I do not know why he did not attempt to carry out his plan of working this earth in large amounts, but I think that the reason given was that the amount of earth was not sufficient. I should think, however, that this is a mistake, for the amount of alluvial earth that might be obtained on this creek, is very great, and it will probably yield gold to its mouth.

The other streams flowing out of this mica schist and hydromica schist region, and falling into Little river, probably contain gold in their alluvial bottoms. It has been found on Laurel creek. There are several other creeks that flow parallel with Brush and Laurel creeks, but nearer to Jacksonville. These, from the drift quartz carried in them, deserve exploration. Little river itself, the recipient of all these streams, ought in its alluvial bottoms to give paying deposits. I fear, however, that this stream is too much of a mountain torrent in its nature, to have formed any important alluvial grounds. At least it had not formed any where I saw it.

The washings first made on the small stream on Walter's place, show a remarkable quantity of gold, when we consider the small amount of water action that was concerned in bringing together this gold, and the small area of ground that was worked over to furnish it. The stream is insignificant, and goes nearly dry in summer. An area of only a few hundred acres is all that could possibly, with the present topography, send its gold into the alluvial matter along this stream. Still, with the extremely rude methods of

washing, and with the use of no quicksilver, as near as I can decide, 12,000 pennyweights would be a small estimate for the amount of gold obtained from about 2 acres of alluvial bottom. On this the pay dirt would not average over 6 inches in thickness. Now these facts indicate, I think, the existence of rich pockets not yet found. Another indication that the present source of most of the alluvial gold has not been found, is the much larger size, and the shape of the grains of the alluvial gold. These are rounded, but not by water action, while the gold in the gneiss and quartz, is in the form of scales and grains, much thiner and smaller than the shot-like ones of the alluvial earth. Again, the dirt in the dry digings on the hill-side at Walter's place, could only have been collected from a much smaller area than that yielding the earth on the stream. These dry digings, in some of the pits opened on the surface of the gneiss ledges, yield a pennyweight to the pan, and a yield of 10–12 grains is not uncommon in the best holes.

Several localities in the Brush Creek region were reported to me as yielding gold by washing. Some of these were mentioned in my paper in *The Virginias*. It is not necessary to specify them here. They may be found all the way to the head of Little river. Most of them were considered to be not paying in the amount of gold. I allude to them here simply to call attention to the fact, that it is not safe to judge of the amount of gold in such deposits, by the fact that the discoverers did not think them worth working. If I may judge by the few persons who were still washing gold at Walter's place, at the time of my visit, they are rather exacting in their estimates of the amount of gold that they would deem sufficient to pay. Those working at Walter's place, did not seem to think that 3 grains to the pan would pay. Indeed, they seemed not satisfied with less than 5 or 6 grains.

Major Guerrant's Arsenical Iron.

Among the mineral deposits of this Brush Creek region that deserve attention, I would mention the deposit of arsenical iron, *Arsenopyrite*, found on Maj. William Guerrant's land, and described in my paper on Brush creek. The large amount of this ore, its favorable situation for working, and the handsome yield of silver that it shows, viz., 34 ounces to the ton, all would seem to render it a deposit well worth utilization. As it occurs in the form of a replacement of the country rock producing a stratum of ore, it dips and strikes with the country rock, and, as it would seem, may be found in any amount desired, the sheet of ore averaging 4 feet in thickness. Only one very slight opening has been made in it. From the frequency with which arsenical iron carries gold, and from the occurence of gold forming an alloy with silver in this region, I feel sure that this deposit will, in some places at least, carry gold with its silver content. The analyses made of the ore from this opening do not show gold. I would suggest that this deposit be traced out and examined at other points. The ore occurs in gneiss similar to that carrying gold on Brush creek, near by, but the deposit has a caping, about 6 inches thick, of hydromica slate.

Galena of Pilot Knob.

Pilot knob, or Abner's knob as it is sometimes called, is situated about 8 miles to the southwest of where the Christiansburg road crosses Pilot mountain. I was induced to visit and examine this knob, by hearing that promising veins of galena had been found in it, and had been worked to some extent. The knob is situated on the northwest side of Pilot mountain, and near to it. It is composed mainly of the magnesian limestone of the Lower Silurian. The horizon is the same as that yielding the galena found in Wythe county. The mineral is found high up on the knob in the limestone. I found that the deposit had been worked by a shaft about 60 feet deep. The limestone strikes 63° E. of N , and dips 70° to the N. N. W. No distinct vein is found, but the mineral occurs here, as it does everywhere else where I have seen it in this limestone, impregnating the rock with small specks and lumps, or else filling the small partings and joints of the limestone. The associated minerals are here the ones usually found in this limestone, viz: galena, zinc-blende, and yellow copper. The two latter occur in minute amounts. The band of limestone through which the galena is found occuring in this way, is about 12 feet wide, but it is sparsely found over this width. Judging from the material taken out, the whole amount of galena is not large, and it would not seem to pay for working.

Galena on Brush Creek.

At various localities in the hydromica schist and mica schists along Brush creek, extending from Slusher's farm near the land of Walter, to the mouth of the creek, pieces of float quartz may be picked up that contain a small amount of galena, but, so far as I have seen, they are not of a character to indicate the existence of workable deposits. The fragments are found, it is true, over a pretty well defined belt, and it is possible that a distinct vein of quartz with galena may occur. I did not see any traces of it. Float quartz with a little galena is found at the mouth of Brush creek, on the land of Mr. Graham. Some little yellow copper occurs with this galena. Though small in amount, this galena looks more promising than any that I saw in this region.

The usual Indian, or old hunter tradition, concerning the melting of lead for bullets out of ore obtained from some spot not now exactly located, may be found applying to numerous portions of the plateau, and among others, the mouth of Brush creek is named. I could find no justification for it unless it be the occurence of the float quartz above mentioned.

The farm of Luster McAlexander, 2 miles south of the mouth of Brush creek, was mentioned to me as yielding both gold and galena. This place is situated in the mica schist belt that lies just southeast of Laurel ridge. The galena was said to occur in a quartz vein, and the gold in alluvial matter on the streams. On visiting the place I could find no galena, but saw an abundance of quartz, some of it in thick veins, appearing to be true fissure veins. Some of these look like auriferous veins, but they showed no visible gold. I have no reason to doubt that wash gold was found on this place, as my informant was reliable. One of these veins had been opened a long time ago for galena, an open pit being sunk upon it. The dump, however, shows no metalic minerals. I think the place deserves farther examination.

Pyrrhotite Deposit of John Light.

This deposit was sufficiently described in *The Virginias* for October, 1882. I refer to it here mainly to correct a misprint concerning the deposit situated nearer to Shawsville, and from which hand specimens were obtained and shown to me by Mr. Light. By a typographical error I am made to say that these specimens were mixed with rock. The statement should be, *not* mixed with rock. I feel confident that excellent pyrite may be obtained in this vicinity. The specimens from the locality above alluded to were pure, solid pyrite, decidedly the best that I saw in the plateau, and not inferior to the best of the Louisa county pyrite. This region certainly deserves the attention of persons in search of pyrite for the manufacture of sulphuric acid

Galena near Alleghany Springs.

At several points to the northeast of Pilot knob, galena and zinc blende occur in the magnesian limestone of the Lower Silurian, and on the same horizon with that of Pilot

knob. I was shown handsome pieces of the zinc ore which were obtained from a locality whose exact position was not learned, on the upper waters of the South Fork of the Roanoke.

Some years ago I visited and examined an interesting deposit in this limestone, situated about 2½ miles south of Alleghany Springs, where limestone over a pretty definite band for the width of several feet, is impregnated with zinc blende and galena in amounts that appear to justify the working of the deposit. Much of the blende has a beautiful, light wax yellow color, and in this the amount of iron seems to be unusually small. A very considerable amount of this and of galena is present. After leaving the spot, I was informed that I did not see the best deposit. There is no vein, but the ore occurs in lumps and particles scattered through the solid limestone, or is found in the joints and crevices of the rock. This galena is said to contain 16 ounces of silver per ton This deposit seems well worthy of development.

The Poor mountains near by are said to contain copper, and I was shown a piece of pure Chalcocite or copper glance, an inch in diameter, that the person possessing it said he picked up in these mountains.

Quartz Veins on Black Run.

Black run is a creek that empties into Little river between Laurel ridge and Jacksonville. On this creek, near Mr. Harman's farm, there are several quartz veins that deserve attention, and one that is quite promising for metaliferous contents. These veins occur in the fine grained mica schist. The most promising vein is exposed on the creek. It is a quartz vein 3 to 4 feet wide, and looks much like auriferous quartz. It shows a good deal of pyrrhotite and a little galena. A considerable amount of pearl spar occurs in the quartz. The presence of this pearl spar, I think, is a good indication. A very little molybdenite is found in this vein. It deserves a more thorough examination than I could give it.

Magnetite near Jacksonville.

On the Wood Gap road, 2 miles S. E. of Jacksonville, a deposit of magnetic iron ore shows on the surface a thickness of 2 feet. The ore is solid and free of rock. Some attempt was made a number of years ago to develop it by an open cut. It was said, however, to pinch out at the depth of 15 feet, and was abandoned. I think it desirable to make a more thorough examination of this deposit before giving it up, as it may well be that the ore was pinched out for a short distance only, as often happens in the case of the magnetite found in these rocks. It is found on the land of Mr. A. Hogan.

Williams' Mineral Veins.

On Pine creek, 3 miles N. E. of Jacksonville, several distinct quartz veins occur on the land of Mr. Powhatan Williams. The most promising of these is situated near the mill. It has been opened by a cut about thirty feet deep. The vein is a true fissure vein, and shows a well defined selvage parting between the vein stuff and wall rock. The quartz is very cellular and porous, having a large amount of limonite in the pores. This indicates that a large amount of sulphurets has been removed by oxidation. A good deal of pyrite is shown in the quartz. Some malachite in crystals and films occur, and some specks of galena may be seen. The vein dips about 80° to the E. N. E., and strikes about 30° W. of N. It occurs in the mica schist belt before described as passing just southeast of Jacksonville. We may call the deposit for the sake of distinction, the "Powhatan vein." The vein stuff taken out was analyzed in the laboratory at the University of Virginia for gold and silver. The best looking specimens showed 4.3 ounces of silver per ton but no gold.

I think that this vein deserves to be examined more thoroughly at this point, and that it should be traced in strike so that other portions of it may be opened. Fissure veins as distinctly formed as this, are rare in these mica schists, and as many metalic minerals, such as gold, silver, galena, and yellow copper, exist at many points scattered in small amounts in this rock, a fissure vein will offer the best chance for finding them concentrated.

About ½ mile to the northeast of this opening, and on the same farm, a band of cellular quartz occurs interstratified with hornblendic mica schist. It from this cause dips and strikes with the country rock. The dip is 60° to the E. S. E., and the strike 55° E. of N. At the time of my visit it was opened at but one place by a pit only a few feet deep. The quartz is quite cellular, and shows a large amount of limonite from decomposed sulphurets. It contains a comparatively large amount of pyrite, a little yellow copper and malachite, with a few specks of galena. We may, for distinction, call this the "Williams vein." The material taken out was examined for gold and silver at the University of Virginia. It showed no gold and 2.6 ounces of silver. This mineral band may be seen on its strike for some distance on the surface. I was informed that attention was called to it by the fact, that lumps of quartz picked up on the outcrop, when broken open showed sometimes particles of pure yellow copper as large as a hen's egg. This band may somewhere on the strike yield workable copper

Toncray Copper Mine.

The Toncray copper mine is situated in Floyd county, 8 miles S. S. E. of Jacksonville on the northwest side of the Blue Ridge, and close to that mountain range. The deposit is contained in mica schist. The mode of occurence and other points concerning this mine, were given in the number of *The Virginias* for October, 1882. I will add here a few statements to the account there given.

I could not examine the interior of the mass of sulphurets, as the workings were not accessible. The vein was opened in search of the black oxide of copper, a large amount of which was found. Two tunnels were made, but the lower one seems to have missed the deposit, not being carried far enough. I could judge of the character of the ore only from what I saw on the dump, taken out of the upper tunnel. This ore has lain in the air for more than 15 years. Most of it is a very solid pyrrhotite, quite free from rock. Scattered through the masses of pyrrhotite, occur particles of the yellow sulphuret of copper. I should estimate that a large amount of the phyrrhotite would yield several per cent of the copper ore. This seemed to be pretty uniformly diffused in a good deal of the ore. The percentage of copper here, so far as I could see and judge from the dumps, is larger than at any of the other so-called copper lodes in the plateau. The copper ore certainly seems to be more generally diffused through the mass of the sulphurets here than it is elsewhere. It is quite probable that fresh sulphurets from this deposit, would show a larger amount of copper than that seen by me. Dr. Stigleman, of Jacksonville, who saw this deposit when it was being worked for copper, has a high opinion of its value. He states that in the walls of the upper tunnel, where it was driven into the deposit, a band of yellow sulphuret of copper could be seen 6 to 8 inches wide.

Shelor Furnace.

This was a small charcoal furnace, erected near the Toncray deposit to utilize the iron ore formed by the oxidation of the outcrop of the sulphurets. This furnace was erected about the begining of this century. The iron made was celebrated for the strength of the castings formed from it. It is said, however, that it would not "weld," and this character was attributed to the presence of a considerable amount

of copper in the ore. I cannot think that this was the cause, as the limonite did not show any signs of the presence of copper such as would be visible, if any notable amount of that metal were present. There is an immense amount of limonite still to be found here. Large quantities of this ore occur also at the Fisher mine This last was described sufficiently in my paper in *The Virginias* for October, 1882. This mine is distant about 2 miles southeast of Toncray. Huge masses of compact pure ore lie on the outcrop of the mingled magnetite and sulphurets found at the Fisher deposit. On the outcrop, this ore seems to be excelent, and any desired amount can be found. As a distinct ledge of magnetite, from 2 to 3 feet thick, occurs with the sulphurets here, this ore on the outcrop, where it is free from the sulphurets, must add greatly to the value of the deposit. I consider that this deposit is worthy of the attention of iron men. If the railroad now being pushed by Mr. Sutherlin from Patrick county towards the Blue Ridge, is ever carried into the plateau, it would open up this region, and render available these large deposits of limonite

At two other localities a few miles to the northeast of the Fisher mine, and apparently on the outcrop of the same mineral belt, large amounts of limonite were reported as existing here. These localities are the "Bear bed," and Rocky knob. Several furnaces could be supplied by these ores. The sulphurets might be utilized for making sulphuric acid, and the residue, even though poor in copper, might in many cases have the copper extracted with profit.

Carroll County.

The description of the rocks of Floyd, given above, applies in the main to those of Carroll. The different bands, as they pass southwest into Carroll, as was before stated, appear to become more metamorphosed, and the crystaline particles to be larger and more distinctly developed. There is also more hornblende, and a larger proportion of true hornblende schist is found in this county. The amount of sulphurets in Carroll is much greater than in Floyd, and they occur in more connected and well defined bands. There is also an immense amount of quartz in veins and massive pockets, much of which is highly charged with pyrite, and some of it presents all the outward characteristics of auriferous quartz. Gold was reported as found at several localities, but I did not have an opportunity to verify the truth of the statements. I think that this county would be an attractive field for an explorer who could devote some time to careful search. The county in its minerals, outside of the large so-called copper lodes, is but little known. I know of no region that looks more promising for the possible discovery of valuable metalic minerals, than some parts of this county.

On leaving the Toncray, my route was across the Blue Ridge to the turnpike leading from Patrick C. H. to Hillsville, the county seat of Carroll. The pike was reached at the "Meadows of Dan" in the northwestern edge of Patrick county. Thence, this road was followed to Hillsville, or Carroll C. H. Examinations were made around Hillsville, and were extended southwest as far as Chestnut creek near its entrance into New river. From Hillsville I returned by the Carroll pike to Jacksonville. I will take up the description of the mineral deposits in the order in whieh they were seen along this route.

Before begining this notice of the minerals, I will give in this place, the heights of several points in, or near the plateau. These elevations cannot be taken as anything more than approximations, I think they give the relative elevations quite nearly, I will begin with the eastern foot of the Blue Ridge, where it was first struck on the road from Rocky Mount.

Heights in the Floyd Plateau above Tide.

Eastern foot of the Blue Ridge at Mr. Saunders'	1150 ft.
Top of Dug Spur gap	2385 "
Floyd C. H., Dr. Stigleman's office	2415 "
Top of Laurel Ridge, Christiansburg road	2595 "
Brush creek at Major Guerrant's	2235 "
Top of Pilot mountain, Christiansburg road	2535 "
Elliott creek, on road to Mt. Auburn	2035 "
Top of Blue Ridge, near Fisher mine	3455 "
Carroll Court House	2575 "

Elliott creek, at the point above mentioned, is the northwestern foot of Pilot mountain.

(To be continued.)

Coal and Coke Traffic of Ches. & Ohio Ry., Oct., 1883.

General Manager C. W. Smith sends *The Virginias* the data for the following statement of the total output and distribution of coal and coke received from mines on line of C. & O. Ry., (including fuel on Lexington division) during Oct., 1883, and October, 1882, in tons of 2,000 lbs., compiled by fuel agent, C. M. Gibson:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	109	3,356	....	3,247
Gas	30,129	29,317	812	.....
Splint and block	10,415	8,310	2,105	.....
New River, &c	30,385	33,917	....	3,532
Coke	9,023	8,463	560	.....
Totals	80,061	83,363	3,477	6,779

This shows a net decrease of 3,302 tons, or about 4 per cent, in Oct., 1883, over same month of 1882. The total movement for Sept., 1883, (See page 154) was 70,161 tons; so the October movement of 1883, was very nearly 10,000 tons more than that of Sept., or the handsome gain of over 14 per cent.

The distribution of the above was as follows;

	1883.	1882.
1. To Ches. & Ohio Co. for its own use	18,534	16,772
2. To Huntington, for West via Ohio river	.....	806
3. On Elizabethtown, Lexington & Big Sandy RR	6,110	4,585
4. On Ches. & Ohio Ry., excepting Richmond.	17,853	15,037
5 To Richmond & Alleghany RR. at Clifton Forge.	1,407	777
6. To Valley RR. of Baltimore & Ohio at Staunton.	.....	25
7. To Shenandoah Valley RR. at Waynesboro	75	3,148
8. To Va. Midland Ry. { At Charlottesville	7,757	6,890
8. To Va. Midland Ry. { At Gordonsville	.....	.....
9. To Richmond, Fredericksb'g & Potomac RR. Junc.	729	645
10. To Richmond for consumption including tugs, &c	10,926	9,367
11. To James River wharves for shipment	.....	10,598
12 To Newport News { Consump'n includ'g tugs &c,	639	139
12 To Newport News { For shipment	16,029	14,580
Totals	80,061	83,363

Considering the depressed condition of manufacturing industries, the above distribution makes a very fair showing, since gains appear to most points.

The following table presents the progressive traffic from January 1 to Oct. 31, inclusive, for 1883 and 1882:

Kind.	1883.	1882.	Increase.	Decrease.
Cannel	20,623	26,341	.....	5,718
Gas	303,289	281,049	22 240	.....
Splint and block	85,085	106,565	.....	20,480
New River, &c	331,390	300,231	31,159	.....
Coke	86,857	76,135	10,722	.....
Totals	8.8,244	790,321	64,121	26,198

The net gains of the 10 months' traffic of 1883, over the same time of 1882, were 37,923 tons, or nearly 5 per cent; this was shared in by gas and New River coals and coke. The splint and block coals of the Kanawha region are now, as a rule, sent westward by water.

The Smoking Nuisance.—In nothing is the decay of, good manners more apparent than in the conduct of tobacco smokers. With one consent, from the gamin to those who in other respects are gentlemen, all smokers, from what we see of them, everywhere, at this time, appear to have settled it in their befoged opinions that non-smokers have no rights, at any place, that they are obliged to respect. A few days ago we even saw a middle aged woman insist upon smoking in a ladies' car.

In evidence of this general demoralization in right doing, we would call the attention to the following extracts from the journals of the day.

"David Dudley Field contributes to a recent number of the *Continent* a stinging censure of the manners of persons who smoke in public places. The censure is thrown away. No thorough gentleman smokes in the presence of other people unless he be in company made up of smokers, and to appeal, however well, to the gentlemanliness of men who are less than gentlemen is a waste of eloquence. The only way of relief is a sturdy uprising of the ladies and gentlemen against the aggressions of under-bred people."—*Syracuse Standard.*

Commenting on the above paragraph the *Evening Post* says: "Yet there are many men who are unconsciously deficient in that regard for the rights and sensibilities of others, which is the vital characteristic of the true gentleman, and who will hold a lighted and smoking cigar in their hands, in crowded elevators, or in cars or stages, to the disgust not only of all non-smokers within short range, but of the more refined classes of smokers. The selfishness of smokers is becoming more common in its manifestations and leads to violations of private rights and public proprieties that would not have been commited a few years ago by American gentlemen of culture and refinement."

"Wanted—something with which decent people can protect themselves from the indecent people who use tobacco. If some person of kindness and genius will invent something which will do it, and which will sell for $1 up to $10, he can make a fortune out of it. For the time has arrived in the history of the world when the long-suffering victims of the ill-manners and depraved habits of tobacco users are going to draw the line and do something about it. Tobacco has always been bad enough, ever since the devil invented it. But at first those who used it had some little regard for the feelings and rights of those to whom it was offensive. Twenty years ago no gentleman would smoke in the company even of other men, without asking if doing so would be unpleasant to those who did not smoke, too; and there were before that time a few men who used it who were so decent that they would go off alone to indulge in the vice, just as they go with proper modesty to perform their toilets, and to other private practices best done in private. But those people are all dead now, and have left no descendants behind them—at least none who smoke. For nobody that we know of has seen any smoker polite enough to do this for twenty years. We are sorry they are all dead, we wish they might have lived always

But the invention we want is something the size and shape of a cigar which can be lighted and set to going on the instant, whenever it is needed as a defense against tobacco-smokers. It should be loaded for the smokers who come up to you and blow their breath loaded with tobacco, catarrh, &c., directly in your face, and should be loaded with something that is just as offensive in odor to smokers as tobacco is to people who do not smoke. It should work with a spring, so that the smoke leaving the foul odor could be shot directly into the eyes, mouth and nose of ths tobacco-smoker, just as he blows his breath and smoke in the face of his victim. We do not know what the odor should be; perhaps it should be of several kinds, if several kinds that are offensive can be found, and as offensive as the tobacco odor is if possible. It would be impossible to find a meaner odor. Perhaps experiment would show that there are one or two odors that are just as offensive to the main body of smokers as tobacco smoke is to those people who do not smoke. If so one or two would be enough "—*Iowa State Register.*

Oct., 1883, Coal Production of West Virginia.—In the Wheeling Intelligencer of Nov. 23, we find the following results of a laudable effort on the part of that enterprising journal to secure reliable information concerning the monthly output of coal from W.Va. mines.—We wish it success,but are by no means hopeful. Our coal operators are about the cleverest set of men we know of, but they cannot be classed as co-operators.

In the latter part of the month of October we forwarded to those operators in West Virginia engaged in mining coal for shipment, a request for information concerning the work of their several mines for the month. They were asked to state the number of men employed during the month, price paid for mining, output, shipments, improvements made or in contemplation, what, if anything, had been done under the mine inspection act, and such other matters as might be of interest to the trade and the public.

It was hoped that the result of these inquiries might be made public soon after the close of the month. Some of the operators responded but omited to sign their names to the printed form, so that their responses are not available. Others have not responded. The exhibit therefore is incomplete and falls far short of showing the magnitude of the month's operations of this growing West Virginia industry. The effort will be repeated this month, in the hope that the operators will co-operate to make this a permanent and valuable feature of the Intelligencer.

The Kanawha Region.

Carkin mine during the month of October had an output of 2,000 bushels; employed an average number of 46 men, and paid two cents per bushel for mining. There were no shipments. Nothing has been done under Mine inspection act.

Winifrede had an output of 239,465 bushels; shiped 373,279 bushels; worked 254 men, and is completing 25 mines. Mines have been inspected and pronounced entirely satisfactory.

The Coal Valley Coal Co., had an output of 2,308 tons; shiped 5,308 tons; employed 45 men, and paid 62 cents per ton.

Union Coal Co., Coal Valley, had an output of 2,350 tons; shiped the same amount; worked an average number of 50 men; paid 62 cents per ton, and is completing its river tipple. The mines have been surveyed under the Mine inspection act.

The Fayette Coal and Coke Co., Stone Cliff, had a daily output during the month of 220 tons—100 tons coked, 120 shiped and used by the C. & O engines; worked 185 men; and paid 50 cents per ton. Facilities for increasing shipments are being made. The prospecting and surveying of a very large tract of coal land owned by T. Y. McKell, of Chillicothe, O.,is being pushed by Mr. N. M. Jenkin, who reports fifty openings over about twenty-five miles of outcrop on the Sewell vein showing an average of five feet nine inches in thickness.

Ohio River Region.

The Hartford City Coal and Salt Co., employed 165 men; had an output of 60,000 bushels of coal used in making salt; produced 50,000 bushels of salt; 10,500 salt barrels; 400,000

staves and heading; and used 35,000 feet of lumber. Nothing has been done under the Mine inspection act.

Fairmont Region B. & O. RR.

The Consolidated Gas Coal Co., of Fairmont employed 56 men, had an output of 3,000 tons, and paid 50 cents per ton. The company is sinking a slope at Barnesville 1,450 feet from the shaft, to be used for ventilation ond other purposes.

The Palatine mines had an output of 3,325 tons, worked 42 men, shiped 1,000 tons, and paid 36 cents per ton. A survey of the mine has been made.

Elk-garden Region.

The Elk-garden mines, in the Elk-Garden region, on the line of the W.Va., C. & P.Ry., had an output of 30,116 tons, and shiped the same amount; worked 300 men, and paid 50 cents per ton. New mine houses are being built. Mines have been surveyed under Inspection act. New mines are to be opened and saw-mills built in the spring.

Coal mining on the Great Kanawha river during the past two years has shown great and steady development. The forthcoming annual report of the Chief of U.S. Engineers will contain some very interesting facts and figures concerning the coal shipments from the Kanawha valley, in their relation to the Government improvements now going on along that river.

During the year ending June 30, 1881, the shipments were; by rail, 6,631,660 bushels; by river, 9,628,696; total 16,260,356 bushels.

The following table shows, by mines, the shipments for the year ending May 31, 1883. It is from the forthcoming report above mentioned.

	By Rail.	By River.	Total.
Winifrede Coal Co,.....	199,868	1,325,791	1,525,659
Robinson Coal Co.,.....	631,107	617,300	1,548,407
Crown Hill Splint Coal Co.,...	610,260	272,604	882,864
Dana Brothers,.....	.....	1,899,789	1,899,789
Mt Morris Coal Co,.....	700,000	.....	700,000
Eagle Coal & Coke Works ...	1,497,810	.....	1,497,810
Coal Valley Coal Co.,.....	1,015,960	.....	1,015,960
The St Clair Co.....	190,000	.....	190,000
Bennington Colliery,.....	.....	394,000	394,000
Campbell Creek Coal Co.,....	.....	3,070,463	3,070,463
Kanawha Mining Co.,.....	613,933	337,296	951,229
Cedar Grove Coal Co,.....	.....	500,000	500,000
Peabody Coal Co.,.....	.....	1,012,234	1,012,234
Crescent Coal Mines,.....	2,016,000	.....	2,016,000
M. T. Davis & Co.,.....	1,102,892	.....	1,102,892
Kanawha Cannel Coal Co,....	50,000	608,000	658,000
F. Faulkner,.....	775.202	8.355	783.557
Cannelton Coal Co,.....	1,068,048	.....	1,060,046
Henson & Talley,.....	239,629	.....	239,629
Marmet Mining Co.....	.....	1,601,188	1,601,188
Pioneer Coal Co.,.....	.....	1,848,715	1,848,715
Wyoming Manufacturing Co,.	242,564	.....	242,564
G. Straughan (Coal Valley)...	762,227	.....	762,227
G. Straughan (N. Coalburg)...	.....	980,000	980,000
Logan Coal and Salt Co.,....	.....	400,000	*400,000
Carver Brothers,.....	1,313,340	.....	1,313,340
Other parties,.....	261,418	474,125	436,341
Totals.....	13,200,225	15,370.458	28,670,713

*Estimated.

Eleven of the mines, it will be noticed, do not ship by river. They are situated above the point to which the Kanawha has been slack-watered. They will be reached, however, by the pool to be made by dam No. 2, located one mile below Cannelton. Work on the lock of this dam was commenced last June. Some of these eleven mines are already building tipples, so as to be ready to ship as soon as the dam is completed. In two years the number of operators has doubled and the amount of coal shiped near The mines given above are situated below the falls, a there are almost as many more above the falls, the f do not more than half show the coal business of the Kanawha Valley.— *Wheeling Intelligencer.*

Kanawha coals in Chicago.—We see by the n reports of the Industrial World, the trade journal of Ch Illinois, of Nov. 29, that Winifrede bituminous coal, the Winifrede mines on the Chesapeake & Ohio Ry the Great Kanawha river, West Virginia, are quoted i Chicago market at $4.50 per ton; 50 cents higher Pittsburg and 25 cents higher than Youghiogheny coal 75 cents higher than the best Indiana or Hocking v Ohio, coals. In the same report Kanawha cannel is q at $6, while Buckeye is but $4.50.

These are good showings for our Kanawha coals in a market, one that consumes a vast quantity of coal, v now, they can only reach by way of Cincinnati and th pense of trans-shipment at that point. When the Ohic tral is completed, or when the Chesapeake & Ohio o Norfolk & Western obtain direct access to the nortl there is every reason for believing that a good marke be found, not only in Chicago, but also in many of the thriving cities of that region, for the high-grade coals Lower, the Middle, and the Upper measures of West ginia,—coals that, by the most exacting tests of goverr officials and disinterested parties, have been placed a head of the lists of semi-bituminous and bituminous cc the United States for steam, coking, blast furnace and purposes.

Longdale furnaces.—The Sentinel, of Covington, ghany county, Va.. has the following account of one c great iron making companies of that county. W pleased that some of our country papers have spac something besides politics,—we hope they will all find for more local information concerning resources, dev ment, etc.:

This furnace is situated in the eastern end of Alleg county, on Simpson creek, a branch of Cowpasture seven miles from the Chesapeake & Ohio Ry. The fu is owned and operated by a stock company of wealthy italists, with F. A. Comley, of Philadelphia, as presi Iron was first made at this point as far back as 1827. I in lies a lesson containing a contrast of former and pr systems of progress. The Longdale Iron Co. was inco ated in 1870, and in the same year the furnace was b in, using charcoal as fuel. In April, 1874, coke was first from Sewell, W. Va. In May following the first cok iron made in Virginia with West Virginia coke, was ma Longdale. The output of the furnace the first year 1,200 tons, its present capacity is 2,500 tons per annu another illustration of progress and development. The nace usually employs 400 men; an advantage to a comn ty that is far reaching in its results. The furnace is plied with genuine brown hematite ore, obtained from company's mines, 4 miles N. E. of the furnace. The ent prospect for the supply from these mines to contin good. These facts, are given that our readers may some idea of the immense benefits flowing from such ir tries, to a county and state. Alleghany can boast of ma the first coke pig iron made in Virginia, she can boast of t large furnaces already in operation, with several mor contemplation; and, more than all, she can say, welcom all such enterprises. The material stored beneath her n ive mountains is sufficient to supply them all. To our zens we would say, let there be a unity of action (not ing) in this matter of home development. We no doub

ourselves open to the charge of repeating a "twice-told-tale" to thus urge upon them the importance of our home interests, but we are interested and mean to convey some of our interest to every reader of the Sentinel. Following the account ot the Longdale furnace we hope to give an insight into the workings of the Low-Moor furnace, then a detailed account of the many mineral deposits of the county.

Tin Ore in Nelson county, Va.—In the Hagerstown Md., Mail, of Dec. 6th, there is quite a lengthy article on Virginia tin ore, from which we make the following extracts. The Nelson county tin region adjoins that of Rockbridge county.

"A few months since, after a visit by one of the proprietors of the Mail to the Crab-tree Falls, near the line of the Shenandoah Valley RR., in Nelson county, Va., an account of which visit was published in our columns, in which the existence of Tin ore upon the property of Messrs. Rittenhouse and Garvin, the owners of the falls, was alluded to. On thanksgiving day Mr Rittenhouse passed through Hagerstown on his return to Virginia, and permited us to make the following extracts from a letter which he had received from Mr. Edgar Whitehead, of Amherst C. H., Va., dated Nov. 19, 1883, in reference to the tin mining operations in his locality."

"The news from the tin valley is very encouraging. We have now open several good cuts. Have made two more at No. 1, at right angles to the first cut, view 20x30 feet, showing good tin ore most of the way. It is like the so-called 'stockworks' of Cornwall.

We have found a well defined vein, 25 feet wide, of the best tin ore at No. 2 (on the mountain) and have cut at two places between Nos. 1 and 2, showing continuity of vein. Mr. Robertson, of Lynchburg, has also cut it 1000 yards above us on Robert Grant's land; vein 12 inches wide and striped to view for 30 feet. There is no longer any doubt of the existence of tin in paying quantities in this basin.

Prof. Silliman writes that the tin ore shows 68 per cent. The samples you took for Prof. McCreath showed 31.62 per cent. (I included wall-rock, the best, medium and indifferent specimens.) This shows well in comparison to Cornwall. While I deprecate any undue excitement, yet I am, as no doubt you are, aware of the fact that a region that bids fair to put the $20,000,000 of import of tin plate (last year's) from one side of the National ledger to the other, has a value that ought to be appreciated by all."

"In the United States tin has been found in Massachusetts, New Hampshire, New York, New Jersey, California, Missouri, Alabama and Virginia. The Virginia mines, rating tin at 10 cents per pound—average analysis 60 per cent from the start—have much more than paid the expense of developing them. In all the other states the tin has been so scattering and the veins when found so thin, as to he unprofitable. While tin ore is among the heaviest, tin itself is the lightest and most fusible of metals."

"The tin area of Virginia probably extends over about 11,000, acres, and the mispickel associated with it is very rich in silver and gold. What the future of Rockbridge, Amherst and Nelson counties may be no one can safely predict. The country is a mountainous one The average elevation where minerals are found is 3,500 feet above sea level; Iron abounds in great quantities; copper is unusually abundant; the country very heavily timbered—an excelent climate and a generous soil; with these advantages, the country must soon shake off its primitive appearance and rival the mineral sections of the great west."

Moonstone of very good quality, resembling the St. Gothard variety and not the Ceylonese, is found at Orange Court-house Va.—*Willliams' Min. Resources of U. S.*

New Analyses of Lick mountain Iron Ores.—Dr. Henry Froehling, of Richmond, Va., has kindly furnished us the following analyses of samples of iron ore selected by himself from ore beds of the Lick Mountain tract, some 14,000 acres, belonging to Mr. Wm. A.Stuart, lying on Lick mountain southeast of Wytheville, Wythe Co., Va. The samples were from the Upper and Lower Hoilman banks, on the north side of Lick mountain, about 3 miles from Wytheville, and from the Jackson bank, on the south side of Lick mountain, adjoining Cripple creek valley and about 10 miles from Wytheville.

Dr.F. informs us that at the Upper Hoilman bank a cut about 66′ long, 4′ wide, and from 3′ to 7′ deep has been made, exposing the ore; that at the Lower Hoilman bank the ore has been exposed by some irregular cutings; and that at the Jackson bank a trench has been cut, exposing the ore, about 54′ long, 3′ to 5′ wide, and from 4′ to 6′ deep.

	No.1	No.2	No.3	No.4	No.5	No.6	No.7
Silica,	7.160	9.020	7.460	1.920	10.980	11.040	12.880
Alumina,	3.965	5.121	2.592	1.775	1.495	2.036	2.404
Iron sesquioxide,	72.662	70.213	75.111	85.725	75.519	73.478	69.396
Manganese protosesquioxide	2.970	2.670	2.370	0.770	1.170	1.170	3.270
Lime,	0.290	0.230	0.160	0.170	0.210	0.260	.....
Magnesia,	0.252	.....	0.288	0.180	0.168	0.180	.....
Phosphoric acid,	1.073	1.166	0.097	0.089	0.486	0.389	0.175
Water,	10.069	11.500	9.805	9.990	10.090	11.256	11.568
Metalic iron,	50.863	49.149	52.578	60.007	52.863	51.435	48.577
Metalic manganese,	2.139	1.923	1.707	0.554	0.843	0.843	2.428
Phosphorus,	0.467	0.508	0.042	0.039	0.212	0.169	0.076

No. 1 represents an average of the upper and No. 2 of the lower end of the cut at the Upper Hoilman bank.—No. 3 represents an average of the ore exposed at the Lower Hoilman bank.—No. 4 is of boulders from a side cut at that bank.—No. 5 represents an average of the ore from the upper third, No. 6 from the middle third, and No. 7 from the lower third of the Jackson bank.

We are not informed as to the geological horizon of these ores, but from the structure of Lick mountain—that being a No. IV crested range—we are inclined to the opinion that they are the ores of formation No. III, the Hudson River slates.

Dana Brothers colliery, on Campbell creek, on north side of Great Kanawha river, Kanawha county, W. Va., is reported, by the St. Albans Nonpareil of Dec. 1, to have an output of 7,000–8,000 bushels a day of semi-cannel coal. Geo. H. Dana is the general superintendent.—This company has 42 railway cars, 100 bank cars and 15 mules in use. The bed of coal mined is from 4 to 6 feet thick, and has slate and stone roofing. The bank is well ventilated. Main entry is 4,000 feet long—has 18 entries. The works were opened about five years ago by the gentlemen now in charge. Miners get 2½ cents per bushel, averaging 100 bushels per day. The miners at Dana Brothers colliery are particularly noted for their sobriety, gentlemanly demeanor and the marks of progressive spirit. The Campbell Creek RR. Co. ships the coal from the bank to the river; company runing 2 engines and 267 cars.

The Robinson Coal Co., of Coalburg, W. Va., on Ches. & Ohio Ry. and Great Kanawha river, made the following distribution of the November, 1883, output of the first-class splint coal that it mines:

Loaded on 297 C. & O. Ry. cars	103,528 bush.
" in barges on Gt. Kanawha river .	93,923 "
" for local trade	5,515 "
Total Nov. output	202,966 "

The mine was worked every day in the month; the actual mining time was 23½ days; 192 hands on pay rolls December 1st.

The Flat-top Coal sections.—On page 175 of our last issue we published a report on the Bluestone-Flat-top Co's (since organized as the Flat-top Coal Co.) lands by Mr. Richard H. Sanders. We are in receipt of a letter from Capt. I. A. Welch, who accompanied Mr. Sanders in his examinations, supplying omissions and correcting some of the statements of Mr. Sanders in reference to the coal beds reported on. We give these corrections below, simply remarking that no one is better informed concerning these coal beds than Capt. Welch, and that we have implicit confidence in his measurements and statements.

"On East fork of Simmons creek bed No. 3 is 9′ 7″ thick with 10″ parting at the bottom and 3″ at the top. At 140′ above No 3 is a bed 4′ 8″ thick with no partings. At 180′ above No. 3 is a coal bed, by road to Saddler's, 4′ 3″.—The two last mentioned beds are 5′ thick on Flipping creek without partings.

On Crane creek, at the Burchett house, bed No. 3 is 6′ thick with 7″ of bony coal at the bottom; on Tolliver branch, just above, the same bed shows 5′ of clear coal on a bony coal bottom. Above No. 3, there, at 160′, is a 6′ bed with partings; at 180′ is a bed with 3′ of clean coal and 1′ 6″ of slate; at 280′ is a bed of 2′ 6′ of coal; and at 380′ a bed with 1′ of coal, 10″ of slate and 3′ of coal,—this last being the highest workable bed in the Flat-top series.

It will be seen that Nos. 4 and 5 are regular in stratification and measurement throughout the property. On North fork of Elkhorn No. 3 is 5′ 6″ without partings, and on the South fork of Elkhorn, on this property, it is 8′ thick, without partings.

By reference to the map of the lands of the Flat-top Co. it will be seen that these lands extend beyond Flat-top mountain and include the head waters of Guyandot and Big Sandy rivers, and that Flat-top mountain traverses the property from Pocahontas to Camp creek, a distance of 36 miles. It carries the workable coal beds of the Crane Creek section, as published in *The Virginias*, for all the distance above named, in the main ridge of Flat-top mountain and in the spurs and ridges that project from that mountain on either side.—The Crane Creek coal section, that I opened up and measured, is correctly published on pages 92 and 93 of *The Virginias* for 1882. The statements as to thickness and character of coal beds, partings, etc, made in that report, are correct and will bear the test of the most rigid examination and criticism."

The Hotel Warwick.—The Old Dominion Land Company, an association of New York capitalists, have recently built a fine hotel, the Warwick, at Newport News, Va., a place that offers many attractions to those who are seeking an agreeable Winter residence under a mild and equable climate. Newport News is situated at the mouth of the James river, eight miles from Old Point Comfort. Newport News is the deep-water terminus of the Chesapeake & Ohio Railway. The Hotel Warwick offers accommodations for about three hundred guests, and may be reached from New York by the Old Dominion line of steamers, or by the Pennsylvania Railroad, via Baltimore, Washington, and Richmond.—*The Evangelist, New York.*

Quinnimont iron.—E. L. Harper & Co. of Cincinnati in announcing that they have been appointed sole sales agents for the iron made at Quinnimont furnace, W. Va., on line of Chesapeake & Ohio Ry., state:—"This iron, as is well known by the many familiar with its merits, is in the forefront of neutral coke irons, and is popular, not alone for its superior qualities in strength and softness, but because of its uniformity of grading. It is preminently a reliable foundry iron."

Flat-top Coal and Coke.—Our last report of the output of the mines and coke ovens of Southwest Virginia Improvement Co., Pocahontas, Tazewell county, Va., was for Sept. (See page 162). Below is the output, in 2,000 pounds tons, for Oct. and Nov., furnished *The Virginias* by Supt. W. A. Lathrop.

	Oct.	Nov.
Coal shiped	10,547	11,036
Coal coked	8,109	8,894
Total output	18,656	19,930

	Oct.	Nov.
Coke shiped	4,685	5,336

The progressive operations of this company, from May 1, to Dec. 1, 1883 show:

Coal shiped	65,188	tons.
Coal coked	33,432	"
Total output of coal	98,620	"
Coke shiped	19,878	tons.

These statements show steady gains in the output of coal and coke, at Pocahontas, such as are very creditable to a new enterprise, the first in a new region.

Iron Market Report.—E. L. Harper & Co. of Cincinnati, under date of Dec. 17, 1883, furnish *The Virginias* the following report: Though the market has been weak, there has been an improved demand, and a general feeling obtains that the bottom has been reached. The elements and conditions warrant the indulgence of expectations of an early change for the better.

The mills report a marked increase of inquiries for manufactured iron, and prices are well maintained The fact that the Nail manufacturers have decided not to close down as they contemplated doing recently, gives tone to the trade. Buyers generally are holding off till after stock-taking, and the movements of crude iron the balance of the year will be comparatively light. If consumers enter the major part of the pig iron orders they indicate they will place in January, there will be an inadequate supply, and should requests approximate what is promised something like a famine in foundry iron may be realized. The market closes with prices well sustained.

Virginia strong neutral Coke, Foundry, No. 1 at $19.50@20.50 4 mos.
Virginia strong neutral Coke, Foundry, No. 2 at $18.50@19.50 4 mos.
Virginia strong neutral Coke, Gray Forge, at $17.25@17.75 4 mos.
Cold short .... at $16.75@17.25 4 mos.
Southern Car Wheel, strictly cold blast at $27.00@28.000.

The Sumac Business of Petersburg, Va., which but a few years ago was in its infancy, has reached large proportions and become a very important industry. The receipts of leaves this year will aggregate over 7,000,000 pounds. Three large factories are kept in constant operation, and their products find ready sale. The Virginia sumac is said to be the best in the market, and has latterly largely superseded the foreign article, Many hundreds of country people make their living in the summer and early fall seasons by gathering the leaves, and for hundreds of miles around the country contributary to the Petersburg market.—*Baltimore Sun.*